THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXI. No. 1815.] LONDON, FEBRUARY 22, 1898. [50TH YEAR. PRICE 6d.

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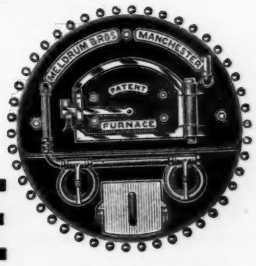

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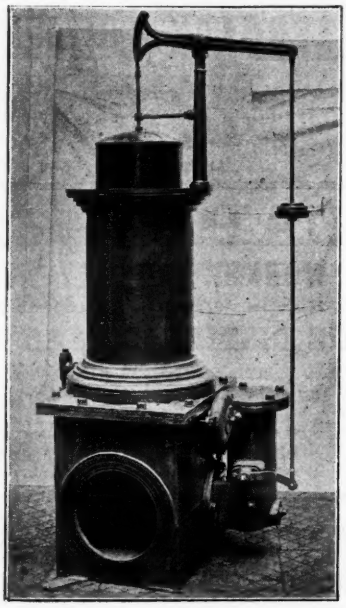

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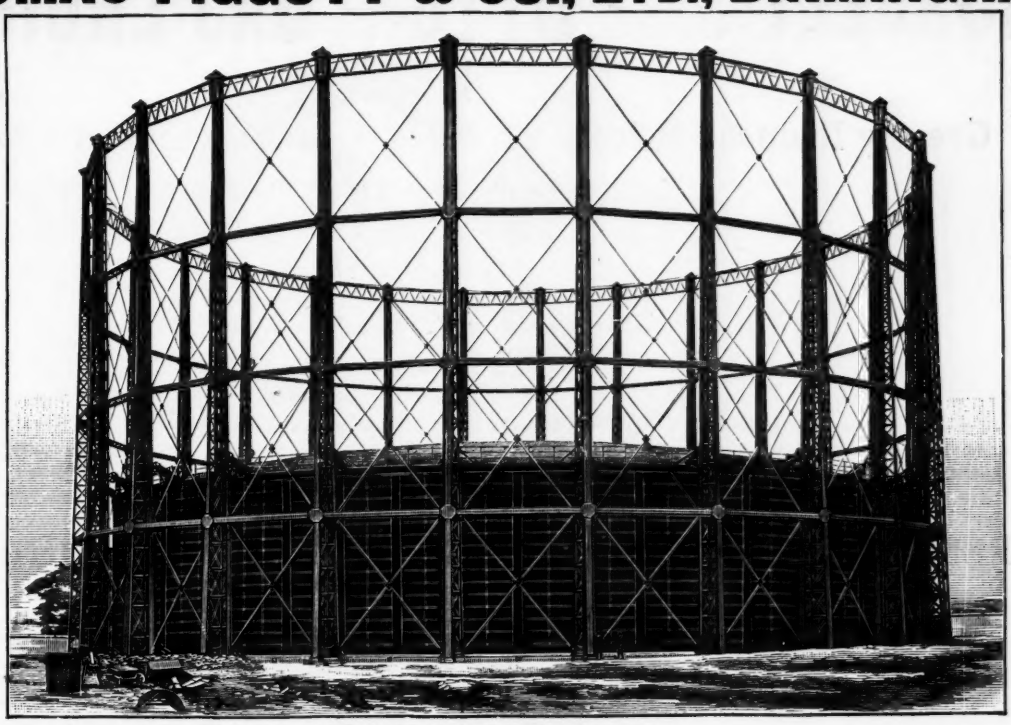

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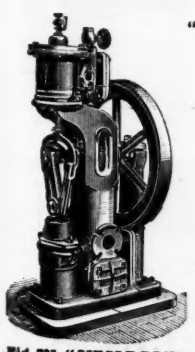

Fig. 703. "SINGLE RAM" STEAM-PUMP.

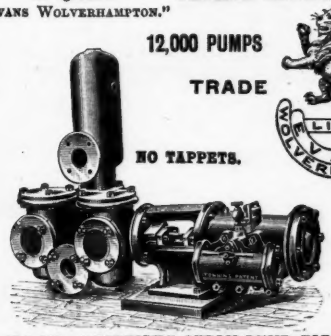

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

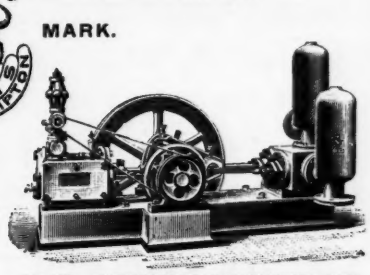

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

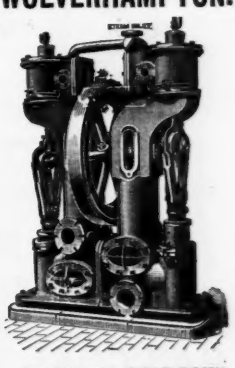

Fig. 713 "DOUBLE-RAM" STEAM-PUMP.

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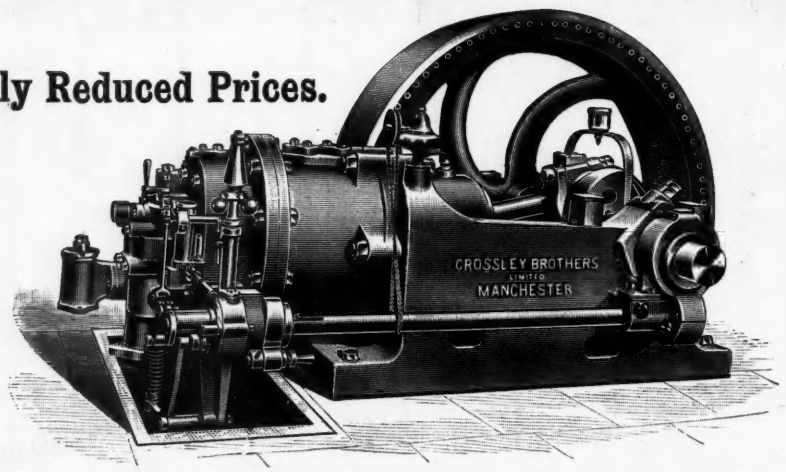

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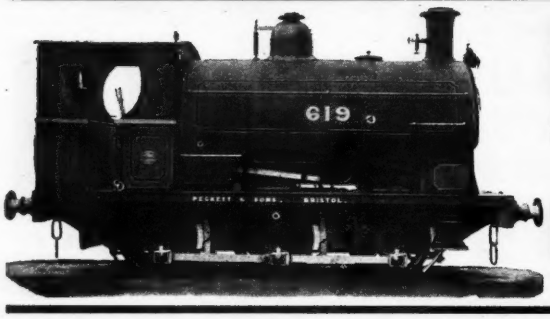

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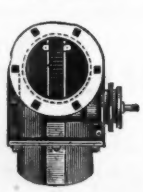

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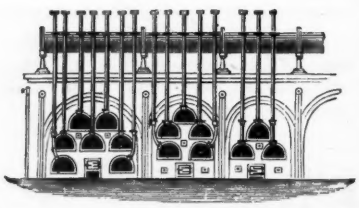

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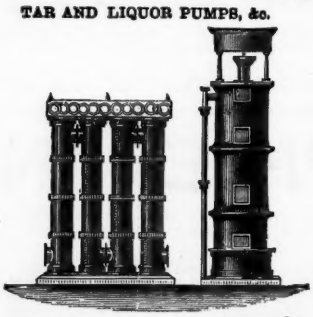

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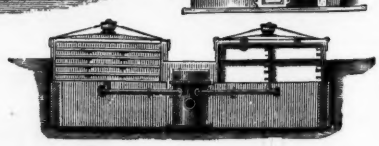

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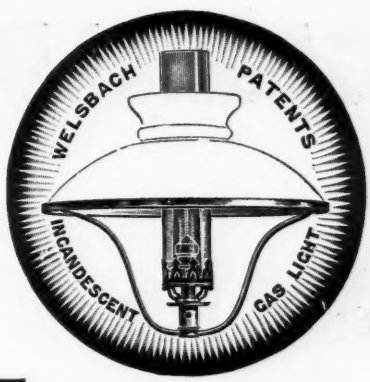

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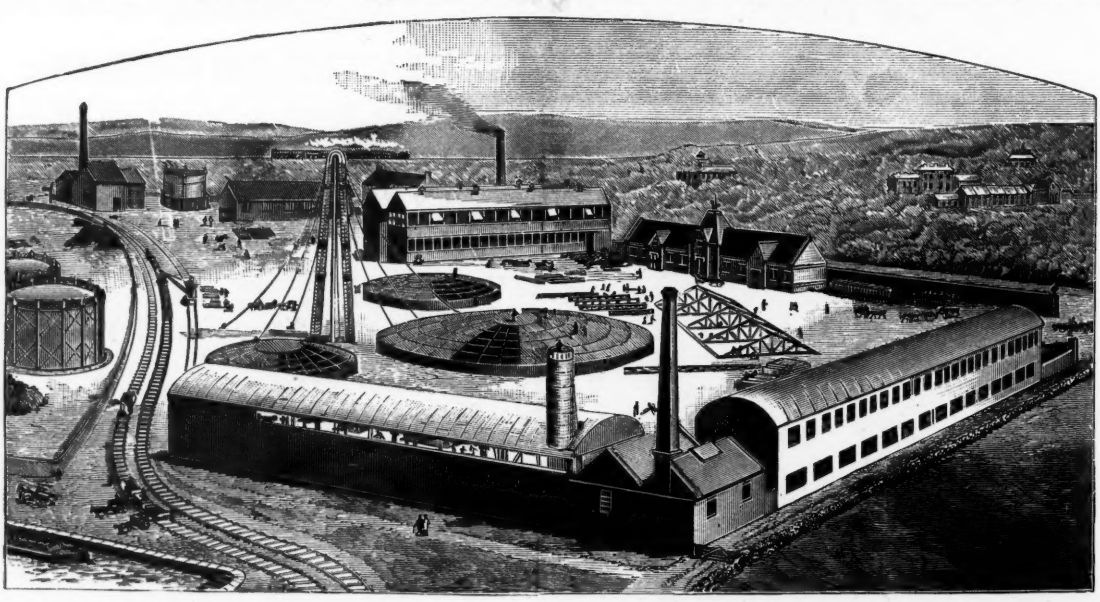

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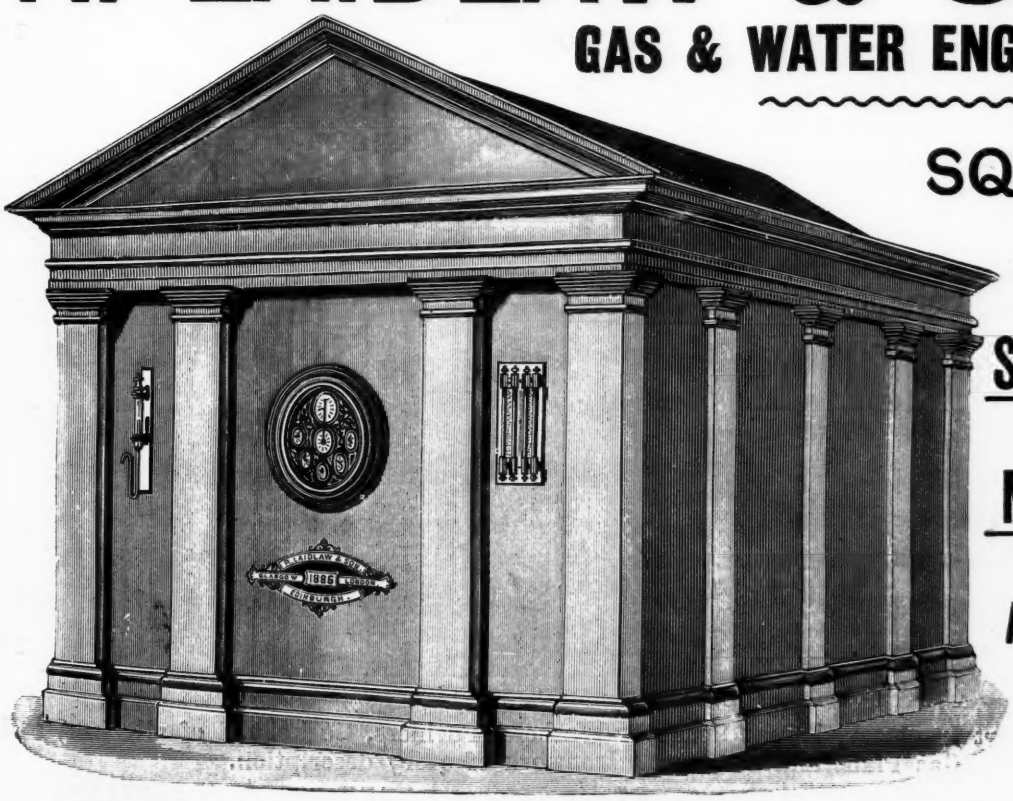

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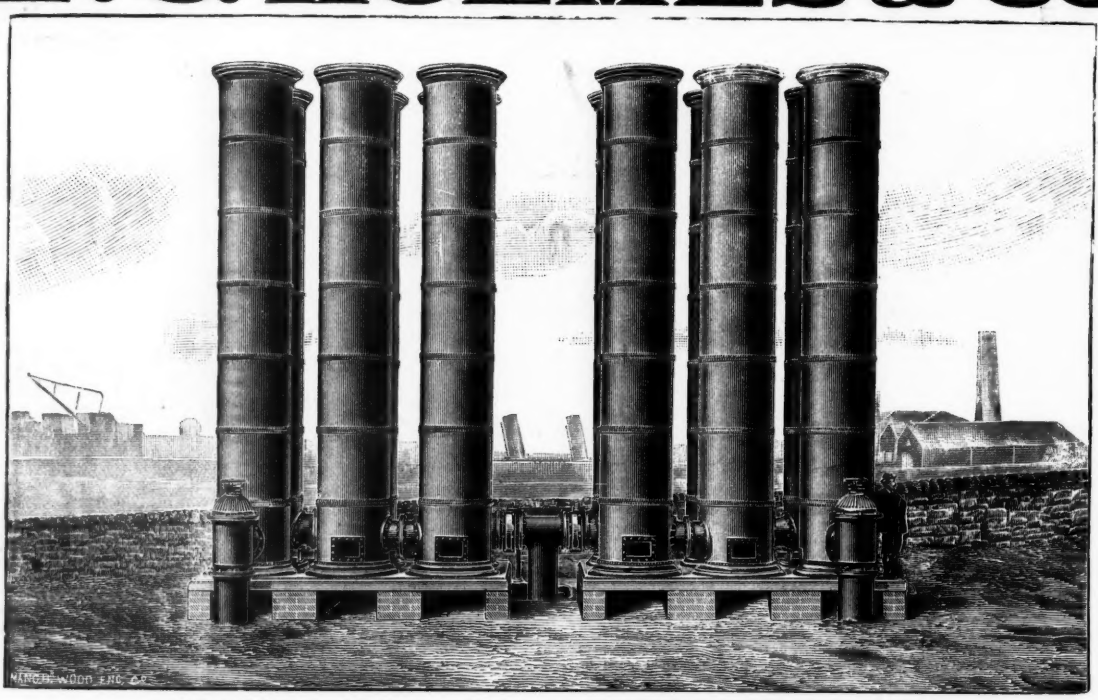

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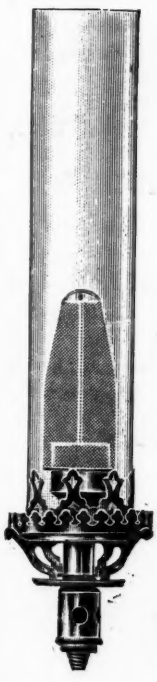

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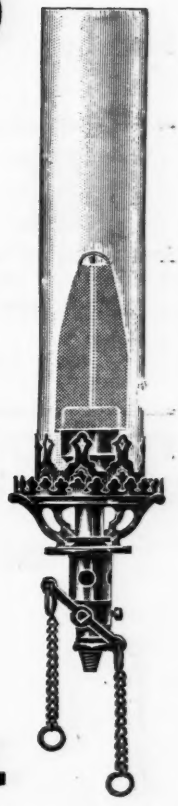

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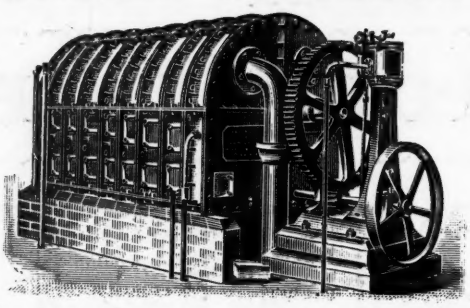

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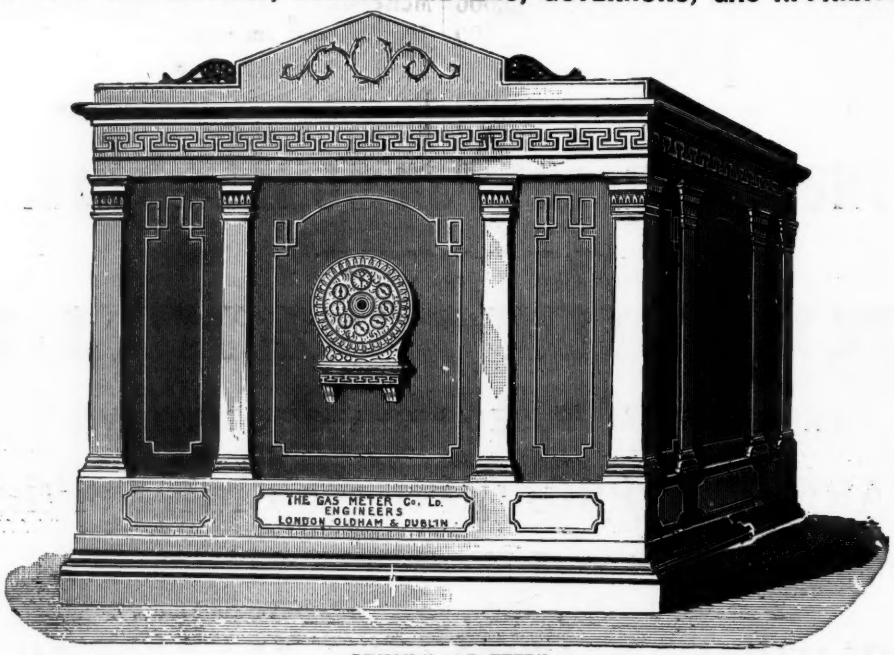

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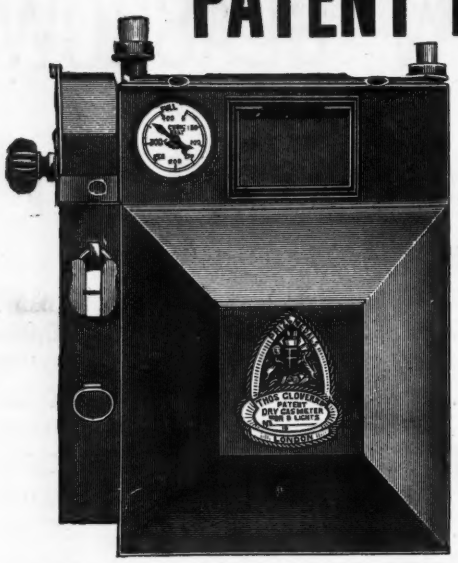

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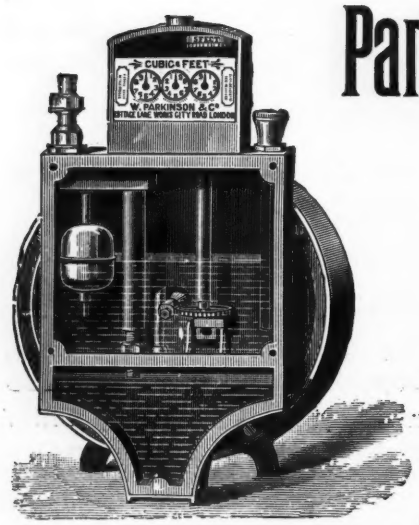

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[See also Advt. p. 440.

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EDITORIAL NOTES.

The Prospects of The Gaslight and Coke Company's Bill.

IN last Saturday's "Times," notice was taken of the fact, recorded in our "Parliamentary Intelligence" to-day, that Mr. Pickersgill has undertaken to oppose The Gaslight and Coke Company's Bill on the second reading. If the opposition is restricted to the proposals contained in the Bill itself, it is possible that he may experience some difficulty in showing sufficient cause for denying to the Company a measure of financial reform which has been conceded to others. But Parliament is never troubled by logic. The frequently expressed opinion of the Governor of the Company, that this huge concern is altogether different in many respects from other Gas Companies, may be shared by the House of Commons in this connection. With regard to the letter of Mr. De la Hooke as to the stock-conversion scheme, mentioned in these columns last Tuesday, it is worth recording that no answer has been made to the writer's assertion that the interest of the public will be injuriously affected by the proposed operation. We have in every case supported schemes of the kind, and cannot withhold support from this, which is, in our judgment, one of the most desirable it is possible to bring forward. The late Mr. J. O. Phillips wanted to simplify the Company's stocks years ago; but for some reason he was unable to complete his plans. Mr. De la Hooke objects to the present scheme because it would tend to obliterate the original conditions of the Company's financial obligations. But the immediate interest of the general public in the Company is limited to the price of gas; and after this it goes no further than the figure at which the undertaking could be bought up by a Local Authority or Gas Trust. In neither of these points is the present Bill in contact with the public interest, to say nothing of injurious opposition. The transfer value of a gas undertaking is governed by the amount of the maintainable profits; and whether these go to pay a dividend of 5 per cent. or 15 per cent. has nothing to do with the valuation. Also, the question of the price at which the Company can supply gas can only be influenced remotely by the consideration of the capital which is sunk in the undertaking being in two or three classes of stocks instead of thirteen or fourteen. Inasmuch as consolidation would tend to render the stock more marketable, and therefore lead to the realization of a better price for new issues at auction, it is to the advantage of the public. Of course, it is beneficial to the existing proprietors also; and this fact opens the door to public opposition.

Once excited and admitted, it will be impossible to limit public opposition to the provisions of the present Bill. The London County Council, or the private members who will join in the opposition to the second reading, will be very careful to keep the issue as broad as possible. It is perfectly obvious that the Company's capital powers are nearly exhausted; and the opposition to the Bill will in all probability open with the objection that the Company's desires and necessities certainly ought not to be dealt with by piecemeal legislation, but as a whole; and this would drive the business over for a year—possibly for two years. It might be argued with considerable weight that the Company would be well advised to take this view of the situation, parliamentary and otherwise, and resolutely set about putting their house in order before the inevitable struggle over the new settlement begins. If there had been the smallest chance of the present Bill going forward as an unopposed measure, or with opposition confined to its own merits, the Company might have gone on with hope. Parliament could not have passed the Bill without endorsing the initial price and sliding-scale, which endorsement would have been useful later on. Now all this prospect is blown to the winds. The declared intention of the Court of Directors to increase the price of gas has set the Local Authorities by the ears; and when the proprietors realize that the dividend cannot be maintained, there will be rebellion in the camp as well as war without. It takes time to produce these effects in the cases of London and the proprietary of The Gaslight and Coke Company; but when the movement is once started, it will be as hard to stop. Even now, it may be doubted if the proprietors as a body understand that as the price of gas goes up their dividend must come down. The Governor was by no means anxious to make a full and correct statement to this effect at the meeting. It was

easy to misunderstand his carefully-chosen words about putting the sliding-scale into operation "to secure the "shareholders their statutory dividend." He spoke as if the matter was optional. Hence it is not surprising that the "Daily Chronicle" of the 15th inst. blunders into the assertion that "this wanton increase of the cost to the "consumer, in order that the sacred 12½ per cent. dividend "shall not be reduced by a fraction, is one of the prices "we pay for the privilege of being served by a monopoly." The Governor was careful not to explain that the dividend would have to be reduced automatically; and here we see the impression he produced upon the enemies of private property in gas supply.

Of course, there will be explanations forthcoming of the confessed failure of the Administration to satisfy either the public or the proprietors. Mr. George Livesey, whose one simple interpretation of the origin of the troubles of the Horseferry Road is not likely to be accepted by those most nearly concerned, must have had this prospect in mind last Friday, when, in regard to another subject, he remarked publicly that failures are always explained, while nobody thinks it necessary to explain success. We greatly doubt if all the explanations that the statistics factory at the Horseferry Road can furnish will facilitate the passage of the Company's present Bill, or help to smooth the way for the next. The facts are enough to bring both Company and sliding-scale into judgment. What the issue of the ordeal may be, is not for us to prophesy. The emergency is far too serious for any talk that is not concentrated upon the facts. It will be found interesting, by the way, to read the speech, reported in the last number of the "JOURNAL," of Mr. Howard C. Ward, in his capacity of Chairman of the Brentford Gas Company, as a commentary on the statements of Colonel Makins and Mr. Livesey at the Chartered meeting in the previous week.

The occasion has been seized by Mr. Will. Thorne, the Secretary of the Gas Workers' and General Labourers' Union, for publishing a protest against the suspicion that the proposed increase in the price of gas is due to the exactions of the Union. Mr. Thorne has written to the "Daily Chronicle" to say that "since 1889 no concessions "have been made to the men engaged in the manufacture "of gas." The same authority is also responsible for the statement that the Company for several years past have been introducing labour-saving machinery "which has "reduced the cost of production in the various depart-"ments from 30 to 50 per cent." It is to be regretted that Mr. Thorne did not show at the same time how this squares with the increasing cost of carbonizing wages of which Mr. Livesey complained at the last meeting. It is quite conceivable that Mr. Thorne should be pleased to recognize the introduction of labour-saving machinery into the works of The Gaslight and Coke Company—provided the wages go up instead of down, in consequence. After this, it is a little cruel of Mr. Thorne to accuse the undertaking of being over-capitalized in comparison with the other London Gas Companies. It certainly does not lie in his mouth to abuse the Horseferry Road with any show of justification.

The South Metropolitan Company's Meeting.

THE meeting of the South Metropolitan Gas Company, on Wednesday last, was well attended. The Chairman of the Company (Mr. George Livesey) presided; and, in moving the adoption of the report and accounts, he delivered one of the discursive, confidentially-turned addresses upon the working of the undertaking to which the proprietors are accustomed. The first matter dealt with by Mr. Livesey was the unwarrantable use made of his name in connection with a certain joint-stock speculation, which has been the subject of legal proceedings. After this personal explanation—which mainly went to show how careful men occupying prominent positions in the industrial world should be in regard to their correspondence—Mr. Livesey sounded the key-note of his speech with the declaration that "the "Directors did *not* contemplate any increase in the price of "gas." It was impossible to misunderstand the bearings of this observation; and the same comment applies to several other remarks of the speaker which there is no need to particularize here. Mr. Livesey declared that the only cause that might lead to an increase in the price of gas by the Company would be a rise in the price of coal, of which he saw no prospect. He was careful, however, to say as much as he could to deter coalowners from trying to put up their prices. Passing to the carbonizing expenses, the Chairman claimed that the management had done very well in this respect. If they had spent money on labour-saving machinery and appliances, at any rate they had saved the labour; and the workmen, being free of all Trade Union influences, had contributed their share towards bringing about the satisfactory result shown in the accounts. On the subject of products, Mr. Livesey was uncompromisingly outspoken in condemning the incapable management and divided counsels that, according to him, have brought about the present condition of the residuals markets. It is quite unnecessary to labour this point here. Mr. Livesey concluded with an interesting statement of the experience of the Company in anticipating the operation of the Workmen's Compensation Act, and a declaration in favour of the maintenance by sliding-scale gas companies of a regular rate of dividend—which, he implied, should be paid out of earnings.

There was only very little discussion. In proof of the intelligent interest taken by the proprietors in the proceedings of the Company, it may be mentioned here that Mr. Bryan Donkin exhibited a diagram prepared by himself, showing graphically the course of the principal factors of the development of the concern during the past ten years. The meeting warmly resented a hint of the Chairman that there might arise a conceivable condition, other than death or disablement, under which he would consider it his duty to retire from his position. For the details of this incident, we must refer to the report of the proceedings in another column.

Trade Union Views of the Late Strike.

SEVERAL influential Trade Unionists have recently spoken their minds—or partly so—upon the consequences of the defeat of the Amalgamated Society of Engineers. One of these is Mr. Burt, M.P., of the Northumbrian Miners, to whose personal repute it would be quite superfluous of us to testify. Mr. Burt remarks that some people appear to think that the collapse of the engineers will lend strength to the movement for securing the eight-hour day by legislation. This, of course, is the cry of the spoilt child of Socialism. After trying all he knows to gain his ends in his own way, and failing, the Socialistic Trade Unionist goes to Parliament for assistance, which he is not in the least likely to get. Mr. Burt tells the working-class voters of this country that if they were to unite and force their views in this regard upon a sufficient number of candidates for Parliament, they might get an Eight-Hour Day Bill passed; but no Act of Parliament would ever serve to compel employers to pay for eight hours at the same price as for nine or ten. The Executive Council of the Boiler Makers—that is to say, Mr. R. Knight—has also reported on the result of the strike. It is candidly observed that "the men have been badly advised in this encounter." The report goes on to protest against the intolerance of Trade Unions expressed by some employers, who "fail to "see that labour and capital are partners in industry, and "that labour has an equal right with capital to defend itself." That is right enough; but the report omits to mention that most of the trouble between employers and Trade Unions has arisen on account of the spokesmen of the latter denying to capital any rights at all—even of existence. How can you carry on business with a partner who is always telling you he wishes you were dead?

Nuisance Caused by the Collection of Workmen in New Localities.

IT not unfrequently happens that gas and water undertakings, and other important public works, have to be constructed in localities previously innocent of establishments of the kind. This means, among other things, the bringing into the new neighbourhood of many men and much material, which is not always regarded with hearty approval by the old proprietors and residents. A good deal is heard, at meetings of the London County Council, and in other assemblies where "Progressive" municipal politics are talked, of the desirability of charging for the "betterment" of landed property by the carrying out of town improvements. Also, the righteousness of diverting the "unearned "increment" of value upon some classes of property from private ownership into public treasuries is understood to be a canon of the Progressive faith. It appears, however, that the Progressive oracle becomes suddenly silent—in short, dries up—when anybody asks what is to be done in cases of "worsement," or "undeserved decrement" of land or other values. Yet every fair-minded person must

perceive that, in the growth of any community, while some sites will improve in value—while the corner "public" expands into the showy hotel, and the convenient wayside shop blossoms into an "emporium"—other places will be very differently affected. The pleasant old residential suburb with walled gardens will be invaded by struggling factories; and many a retired estate will be prejudiced in no small degree by the erection of smoky, noisy "works" upon its borders.

A curious illustration of this process was afforded by some recent litigation in which the London County Council and one of their Building Contractors figured as defendants. The plaintiffs in the case, who were the owners and the occupiers of a farm at Epsom, applied for an injunction to restrain the defendants from injuriously affecting them by causing crowds of disorderly persons to assemble in the vicinity of their property. It appeared that the County Council had bought a large estate at Epsom, upon which they proposed to erect a pauper lunatic asylum; and they let to the other defendants the contract for the foundations. It is easy to imagine how very wroth the neighbours became at this invasion. The "worsement" became acute, however, when the army of workmen imported into the neighbourhood by the defendants took to following short cuts across the adjoining property, and making free generally, after their manner, with the neighbours' unconsidered trifles of wood and vegetables. "The "plaintiffs' case was that, in consequence of the defendants "not providing proper accommodation for the men, and not "fencing off the road by which they went to and from the "works, various acts of trespass and nuisance had been "committed upon the plaintiffs' property. They alleged "that the workmen had, amongst other things, broken "down their fences, taken and used the wood for fires, "trodden down and destroyed the crops, caused the cattle "to stray, slept in the barns, used the hay, and committed "acts of nuisance and indecency upon their lands." The defence of the County Council was that the men were not their servants; and of the Contractors, that they could not be responsible for what the workmen did in their private capacity before coming to or after leaving work. The trouble was just one of those real, but vague inflictions which constitute the "worsement" of a property. Naturally, the County Council could not see it. The Court, too, experienced some difficulty in bringing the case under the law laid down with regard to the causing of crowds of disorderly persons to assemble. Eventually, the Judge declined to interfere by way of interlocutory injunction, but advised the County Council "to take care to minimize "the inconvenience caused to neighbouring owners and "occupiers by the presence of so large a body of men under "imperfect control." This counsel is susceptible of many interpretations.

The Government Companies' Bill.

In the Queen's Speech at the opening of Parliament, mention was made of a Government Bill for further regulating the affairs of joint-stock companies. This measure has been introduced and read a second time in the House of Lords, and referred to a Select Committee. It is in charge of the Earl of Dudley, and is the same measure which passed its second reading both last session and the session before. Last year it was referred to a Select Committee, who collected a great mass of evidence, and were unable to complete their work. Now the Committee will be re-appointed and continue their labours, which it is hoped will bear fruit before the session is ended. It is useless to describe the leading provisions of the Bill, because there is every reason to believe that the work of the Committee will result in important modification of its scope and particular requirements. Speaking generally, however, it is sought to make the responsibility of Directors more real than it is at present. The prospectus of every new Company also is to give the contents of the Memorandum of Association, the amount of Directors' qualification, the minimum subscription on which allotments will take place, full particulars of the property to be purchased and the amount payable for it, the amount of the commission, the amount of the preliminary expenses, the promotion-money, the working capital, and the effect of every material contract and fact known to the Directors or promoters of the Company. There is a good deal more of a similar kind; for the purification of the company-promoting business is a large order.

WATER AND SANITARY AFFAIRS.

The Metropolitan Water Supply Commission sat for two days last week, receiving the evidence of Mr. Gomme, the Statistical Officer of the London County Council. This witness declared himself decidedly in favour of a revision of the charges, as well as of the capital, of the London Water Companies—that is, supposing control was to be provided. But for all the several defects and misdeeds of the Companies he could suggest no remedy excepting purchase; his belief being that efficient control was impossible. If there was to be control at all, he suggested something in respect to capital which the Chairman described as apparently "very drastic." Mr. Gomme's idea was that Parliament should exclude all "dead capital," and cut down the whole amount to that portion which was earning income at the present time. The Chairman wanted to know what was to become of the shareholders who had advanced the capital which was described as having become "dead." Were they also to be extinguished? Mr. Gomme signified that he would prefer to reduce the value of the shares all round. The equity of this procedure was never discussed; and Mr. Gomme adhered to his conception that the only capital to be considered at the present moment was the value of the works in effective use. According to this mode of valuation, it would seem that some portion of the plant would not even figure in the capital account for its worth as old iron. As Mr. Gomme told Mr. Mellor, such capital would be "ex-"cluded," being dead. For example, the money which had been expended on intakes subsequently abandoned was "obsolete;" and this expenditure, it was signified, ought not to be included in the present capital of the Companies. In plain words, dividend should not be paid on it. There was the case of the East London Company, who had expended £130,000 in purchasing the works of the Shadwell Company in 1809, which works included "a lot of wooden "pipes." This large expenditure on capital account was among the dead and obsolete, and, on Mr. Gomme's principle, would be ignored, although it could not be said that it never had an existence. This seems to be a new way of paying old debts, and provides an easy bargain for the County Council through the medium of a special arbitration. Sometimes the sword has two edges; and so we find the Chairman of the Commission inquiring whether, in the event of the County Council purchasing the undertakings of the Companies, and then substituting the Welsh supply, so as to render the greater part of the present works obsolete, Mr. Gomme's plan for the review of capital would be enforced as against the Council. But of course, Mr. Gomme said "No." The case, he considered, would be met by means of a sinking fund, which the County Council would be under the necessity of providing. But this very sinking fund would be a burden on the ratepayers, from which they are now exempt. Looking carefully down all Mr. Gomme's proposals—if, indeed, we have heard the last—with regard to capital, dividends, rates of charge, assessments, and other matters, with all the clipping and shrinking involved, we are ready to ask what will be left. The apple is to be peeled so close that the veriest stump alone will remain. The scheme may be statistical; but it is certainly drastic.

At the special general meeting of the Southwark and Vauxhall Water Company, held last week, for the purpose of considering the Company's Bill now before Parliament, Alderman Sir Henry E. Knight mentioned that, although the Company were asking Parliament to increase their power to take water from the Thames to 45 million gallons in place of only 24½ millions per day, it did not follow that they would take more than the 38 millions they were drawing at the present time, unless the demands of their district required it. On the previous day, the "Daily "Chronicle" gave circulation to the statement that the pending Bill would empower the Company to draw from the Thames about double the quantity of water they take at present. Accordingly this would be about 76 million gallons per day; whereas the proposed maximum is only 45 million gallons, which may not be reached for years to come. Whenever so much is taken, it will simply be because it is wanted. But the County Council will consent to the enlarged draught, providing the excess is limited to the period of one year. If one year, why not two years, and why not more? It is impossible to throw

the draught back to 24½ million gallons per day. The Parliamentary Committee of the County Council say: "We think that the present is the most inopportune "time for such a Bill as this to be brought before "Parliament, having regard to the fact that the Royal "Commission is now sitting dealing with the water "question." But the Royal Commissioners cannot restrain the demands of the consumers; and whatever may be the nature of their report, no legislative action can be taken upon it for some time to come—rendering any essential change very remote indeed. Is the Welsh supply to arrive in another year, or will it come in ten years? and in the meantime where must the growing population of the Southwark and Vauxhall district look for an adequate water supply? Moreover, there is the agreement made between the Company and the Thames Conservancy, with the sanction of the Select Committee of last year, that the Company would bring in a Bill in the present session, not merely for tacking on another year, but for effecting a permanent settlement of the question. The policy of the County Council is merely obstructive, and is devoid of all practical merit. Sir H. E. Knight states that Parliament actually bound the Company to bring in a Bill this session similar to that of last year, in order that the whole question might be thoroughly gone into. There seems nothing new to be said, except that the present moment is "inopportune," because the Royal Commission are holding their sittings. When the Commission cease to sit, the enlarged supply will still be wanted; and the demand will not cease to grow. The "Daily Chronicle" says that the Thames Conservancy have resolved, in common with the Surrey County Council, to offer strenuous opposition to some of the provisions of the Company's Bill. Will these authorities object to the proposed extension of the storage reservoirs? Yet such works are designed for the protection of the river as well as the benefit of the consumer; and the Conservators of the Thames are not likely to quarrel with such provision. The Grand Junction Company also held a meeting last week, when the Bill of the Staines Reservoirs Joint Committee was approved, proposing the execution of further works, and the raising of a quarter of a million of capital in addition to the million already authorized. While the Companies are thus seeking to expend money for useful purposes, a Parliamentary Return makes its appearance, showing that in the course of the seven years ended last August the County Council expended £12,000 in conducting inquiries relative to the London Water Question, and £30,000 in the promotion of Bills relating to the supply of water in the Administrative County. A total of £42,000 has thus been spent, without benefit to the consumers, but rather to their injury.

The Cost of the Public Lighting Service of the South Metropolitan Gas Company.—Referring to the remark upon this head which appears in the editorial notice of the above-named Company's accounts for the past half year, we desire to make a correction. The total charge for the whole year amounted to £13,675, or 13s. 4d. per lamp per annum. Moreover, the stated number of public lamps includes some that are not lighted and cleaned by the Company. The Company's regular charge is 16s. 6d. a lamp per annum for lighting, cleaning, repairing, &c.; and out of this they do not consider they make any profit.

Liberty and Property Defence League.—The report of the Liberty and Property Defence League for 1897 states that the membership continues to increase, and gives the number of societies representing the various interests in the country which are federated with the League as 207. The report narrates the history of the formation of the Free Labour Protection Association; and it is claimed that in developing the idea of a National Federation of Employers, the League has rendered such an important service to employers and employed in their fight with Trade Union Socialism as to afford of itself sufficient justification for the League's existence during the last fifteen years. The chief interest in the report centres in the League's parliamentary work. The successive steps comprised in the process of blocking Bills are recorded, and particulars given of the part taken by the Parliamentary Committee of the League in securing the defeat of various Bills affecting land and house property, railways, mines, trades and manufactures, shipping, &c. The League claims to have defeated the Steam Engines and Boilers (Persons in Charge) Bill after its second reading, by explaining its character in a memorandum distributed among members of Parliament, the Press, and the general public. Strong endeavours were made to obtain the rejection of the Workmen (Compensation for Accidents) Bill, to achieve which object Lord Wemyss unsuccessfully divided the House on the third reading. Unfortunately, the Council have to report a falling off in the income of the League.

ESSAYS, COMMENTARIES, AND REVIEWS

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 425.)

THE course of the stock markets has been far from satisfactory during the past week, culminating on Saturday with a regular break in all the leading departments on the critical condition of affairs in West Africa. The statements made in the House of Commons on Friday took the Stock Exchange quite by surprise; and dealers, fearing sales, commenced business on Saturday by quoting lower prices all round. Then operators with commitments open for the rise hastily closed their accounts in view of the settlement. Prices consequently fell heavily for the first hour; but a rally subsequently ensued on the receipt of better quotations from Paris. A certain uneasiness is felt about French internal politics, while the news from the Transvaal is far from reassuring, so that a drooping tendency has prevailed, and stopped fresh dealings to a large extent. Money has also shown a harder tendency, by reason of the accumulation of taxes in the Bank of England to the Government credit; but the period of tight money, through this cause, is drawing to an end. All the leading stocks marked a considerable decline; and miscellaneous stocks were likewise lower on realizations. Welsbach incandescent ordinary stock has fallen to about 120; and the deferred shares are also easier. As regards Gas stock, Gaslight "A" has been active throughout the week; the price falling to 297–302. But a better tone subsequently prevailed, as the lower values brought in buyers; and the price rallied to 298–303, though marking a further decline of 2 per cent. on the week. The secured stocks were dealt in to a small extent; the 4 per cent. "B" advancing to 120–125. An inquiry also prevailed for South Metropolitan; but the quotation remains unaltered. As to the Suburban and Provincial section, Brentford new was wanted, and rose 3 to 230–235; but Crystal Palace ordinary fell 1 to 136–139. With respect to the Foreign section, Imperial Continental lost 2, the price receding to 218–223; and Bombay (fully paid) fell ¼ to 6½–7. On the other hand, Monte Video rose ½ to 15½–16½. There was a little more doing in Water stocks; and Kent recovered 1, being quoted 358–363. New River debentures are also up 1, at 148–153; and West Middlesex 2, at 319–324. But Southwark and Vauxhall debentures fell 1, to 146–149.

The daily operations were: On Monday, the feature was the activity of Gaslight "A," between 300 and 302; but the quotation was maintained. Business was done in South Metropolitan at 147½; in Brighton and Hove ordinary, at 278½; British Gas, at 56¾; and in River Plate, at 9¾—the debentures of the latter Company advancing 1, to 99–101, which was the only change in Gas stocks. Water securities were likewise steady. Tuesday again saw considerable dealings in Gaslight "A," which fell 3, to 297–302; while Gaslight "B" rose 7, to 119–124. River Plate ordinary was active, and ¼ lower at 9½–10. Water stocks were quite featureless; no business being officially recorded. Wednesday was quiet; the only change being a rise of 1 in Gaslight "B," to 120–125; but Gaslight "A" was again active between 297 and 300. Water stocks were quiet; very little business being officially recorded. Transactions in Gaslight "A" were again brisk on Thursday; and prices recovered 1, to 298–303. Imperial Continental, on the other hand, was weak at a fall of 2, to 218–223. Among Water stocks, Kent rose 1, to 358–363. On Friday, a number of dealings were recorded in Gaslight stocks; business being transacted in the secured stocks, as well as the "A." The only changes, however, were a rise of 3 in Brentford new stock, to 230–235; and ½ in Monte Video, to 15½–16½. Among Water stocks, New River debenture fell 2, to 148–153; and Southwark and Vauxhall "A" debentures 1, to 146–149. Despite the general weakness of the Stock Markets on Saturday, Gas and Water stocks remained steady.

ELECTRIC LIGHTING MEMORANDA.

The Scandal of Shoreditch—Warning to Public Officials—The Depreciation of Electric Mains—Death by Electricity.

THE importance of the principle at stake must be our excuse for returning this week to the subject of dust destruction and electric lighting by the Shoreditch Vestry. A fortnight ago we protested strongly against the line of conduct taken in this regard by Mr. H. E. Kershaw, the Chairman of the Electric Lighting Committee of the Vestry; and from what has since come to our knowledge as to the use that is being made of his name and official statements, we think it right to repeat the protest, with emphasis. Mr. Kershaw brought forward a recommendation for the immediate reduction of the price of current supplied from the Shoreditch installation, in terms which would have been more suitable for a trade advertisement of the particular dust-destructor and electricity-generating combination in use (more or less) by the Committee over which he presides, than they were in an official minute. The majority of the Vestry, not having parted with all their common sense, as we remarked, rejected the recommendation. But what do we see? That the terms of it, with a carefully prepared abstract of Mr. Kershaw's laudatory speech upon it, have been distributed broadcast

through the Press, without mention in all cases of the fact that the resolution thus supported was rejected. Naturally, after the apparently independent Press notice will come the trade circular, giving the name and address of the firms whose work is in question. Local authorities everywhere will be bombarded with appeals to try So-and-So's patent dust destructor and cheap electricity generator, "than which none other is genuine." They will be implored to "ask for the Shoreditch brand," and warned to "be sure that they get it."

Of course, in these days, one does not blame business men for "booming" their trade interest for all it is worth, by any agency at their command for the purpose. It is difficult, however, to criticize with sufficient severity, in restrained language, the lack of proper sense of personal dignity and official responsibility—to put it as mildly as possible—that must be charged upon those members of public bodies who lend themselves to this "booming" operation. One could not say for certain, of course, that Mr. Kershaw's recommendation to the Vestry of Shoreditch, couched though it was in the language of an advertisement, was intended to serve this purpose. But we can and do say that the prospect of its being so employed should have been before Mr. Kershaw; and he should have refrained from wording his resolution—assuming it to have been necessary for the Committee to make such a proposal at all—so as to avoid giving it the look of a testimonial. One cannot say, to prevent its use for any such purpose; because there is no knowing what traders will twist into a testimonial of their wares. If public men were to be careful to confine their counsels to deductions from facts which they were at the same time prepared to cite, they would at least be free from the reproach of partisanship, which never fails to carry unpleasant aspersions in its train.

A thoughtful article upon certain considerations of interest in connection with electricity supply from central stations appears in the current number of the "Electrical Review." It is remarked that just at this season the working accounts of many electricity supply undertakings are being made up, and the statistics they furnish are being studied with enthusiasm. It is observed that probably the majority of the concerns aged over three years or so will be found to have turned the corner where both ends meet, and consequently suggest the question of profits. The first thing to be considered at this stage of such undertakings is, we are reminded, the proper provision to be made for depreciation. Here arises a formidable difficulty. Buildings, generating plant, and other gear may be dealt with in the light of knowledge, though even in these regards accident or mischance may occur to upset calculations; but who can say what should be taken as a lifetime of the distributing mains? This, says our contemporary, is a "most serious question." Obviously, bars of bare copper supported on porcelain insulators laid in stoneware conduits are not perishable; but circumstances have prevented this system being carried out in its entirety anywhere. Generally some pattern of insulated cable drawn into cast-iron pipes has been resorted to, on account of cheapness of first cost and laying; but these are the more perishable the farther they depart from the sweet simplicity of bare copper. And there is no means of knowing how fast they are perishing in any particular case. Wherefore our contemporary urges upon all administrators of electric lighting undertakings the desirability of weighing the consideration of depreciation before deciding the question of profit. It is good counsel.

The gruesome topic of death by electricity is something that all technicians would prefer to keep somewhere "in the back of their heads;" but it is not to be denied that the threatened extension throughout the United Kingdom of electric tramways contains the possibility of making the British public more familiar with this class of fatality. Improvements recently effected in the distributing plant of electric lighting stations have checked what looked at one time like a new street danger; but the trolley wire, wherever it goes, must of necessity be a dangerous element of street equipment. There is no getting over this feature of the system. The wire must be naked; and it must carry a charge of electricity capable of killing any living organism through which it may be induced to discharge itself. It means, in brief, "lightning laid on," and only waiting to be tapped. Curiously enough, the mechanism of death by electric shock is not well understood. Natural lightning may tear a living animal's vitals, and then the cause of death is clear; but this is seldom or never the case with industrial electricity. Summing up recent contributions to the medical history of the subject, Dr. W. S. Hedley states that science has not progressed beyond the conclusion enunciated by D'Arsonval—that a victim of electric shock should be treated as one apparently drowned—by artificial respiration commenced early and continued long.

Willis's "Workmen's Compensation Act, 1897."—We noticed some months ago the publication, by Messrs. Butterworth and Co, of the useful annotations to the above-named Act which had been made by Mr. W. Addington Willis, LL.B. A third edition of the work has been issued, containing further explanatory notes, and an analysis of a proposed scheme to be substituted for the provisions of the Act, after having been certified by the Chief Registrar of Friendly Societies. A copy of the form of application for the certificate is given in an appendix. These additions enhance the value of the book, the utility of which has already been widely recognized.

THE LONDON COUNTY COUNCIL AND THE MUNICIPALIZATION OF PUBLIC WORKS.

THE question of the expediency of municipal bodies undertaking public works is one of those problems of practical politics that always remain with us, and are always open. It continually crops up in strange places as well as under familiar conditions, and sometimes takes a wide scope, while at others it appears to be limited to a small issue. The latest recrudescence of the question in its more important aspect is registered for English people in the letter of Sir John Lubbock to "The Times" (already mentioned in the "JOURNAL") upon the real issue to be decided at the forthcoming election of a new London County Council. The fact that Sir John Lubbock's statement in this regard is disputed by those who are opposed to his views, does not alter the position, because there is reason to believe that some of these opponents fail to realize the existence in their proceedings of any such general policy as Sir John Lubbock has exposed. Thus, upon the single matter of the way in which a British Municipality is empowered to carry out the Housing Act, Sir John Lubbock shows that this can be done upon two systems—either the authority can act directly on its own account, or can consent to action being taken by other bodies or persons under its supervision. This alternative is afforded by numerous other statutes relating to local self-government, including the Public Health Acts, where the subject of public lighting comes into regulation. One of Sir John Lubbock's critics ventures to say that "the subsequent question as to whether a Company or the Council shall build the dwellings is a small matter so far as the ratepayer is concerned." But this, as Sir John Lubbock justly argues by way of rejoinder, is really *the* important matter for the ratepayers and everybody else concerned. Is it nothing, one might inquire, whether the gas supply or the tramway service of a district is in public or in private hands?

Here we may pause to inquire what has been the general tendency of local self-government legislation in England in regard to this order of questions; and this is fortunately not difficult. Broadly stated, legislation for the last sixty years has gone on the simple lines that where improved public services were needed and could not be efficiently rendered by existing agencies, the local authority might take them in hand, paying all due regard to vested interests. Moreover, as all this legislation had its origin in the economic and social renascence of the present century, which, beginning with Parliamentary Reform, spread in time to every hamlet in the land, it was motived by the same principles that inspired the leaders of the great Reform movement. These leaders were Cobden, Bright, Mill, Fawcett, and others; and they all left writings from which we can learn what their principles were. As summarized by Sir John Lubbock, these principles were "that Governments and Municipalities should govern and not trade, that private enterprise should be encouraged, and that trade and manufactures should only be undertaken by Governments and Municipalities under most exceptional circumstances." The words of John Stuart Mill on this subject were: "There is a fundamental distinction between controlling business and actually doing it;" and "control is the more perfect the less the actual conduct of business is attempted." Cobden also, in his great speech on Government manufactories, said that the system "is wholly unsound; that there is an utter absence of responsibility; that there are none of those motives for saving money or avoiding losses which private individuals have; and that, wanting the motives which are necessary for human action, it is impossible that these establishments can be carried on properly." Modern Progressivism has other views about the matter. As Sir John Lubbock puts it: "We see now, unfortunately, a craving for the municipalization of every large industry. The question no longer is what should be done by Governments or Municipalities, but why should anything be left to private enterprise."

At a meeting held in London last week, the Duke of Devonshire expressed similar views of the nature of Progessivism in municipal politics. His Grace protested against all attempts on the part of the County Council to do for London that which can be much better done by private enterprise and private capital. He went on to say: "I do not deny that in many parts of the country municipalities have adminstered with success certain enterprises, such as the supply of gas and of water, more or less in the nature of monopolies; and I admit that it is a perfectly fair question whether, in the interests of the inhabitants of London, the County Council should not undertake the control of such enterprises. Here, also, I would only say, at least in the case of London, our undertakings are of such magnitude that I think you ought to be very well satisfied with the capacity and knowledge of those who are going to undertake them before you displace the existing system." It is sufficient for the present to observe, by way of comment upon the examples of successful municipal enterprise referred to here, that in every case the Act of municipalization was sanctioned by Parliament on its merits, with strict regard to expediency, and not upon any *à priori* consideration whatever. Progressivism, however, take no account of expediency. It is the municipal development of Socialism, which notoriously disregards economy when it is a question of the realization of an ideal. There is another practical application of Socialist principles in the region of municipal affairs, and

that is Trade Unionism. The Trade Unions, as the Duke of Devonshire does not omit to mention, have captured the London County Council. His Grace gave a somewhat novel account of the genesis of the notorious Works Department of this body. Under Trade Union influence, the County Council inserted such onerous conditions in their contracts, that the best firms could not touch the County Council work. Hence the Council had to do their work themselves; and the only check upon the cost of this policy has been the estimates of the Architect's and Engineer's Departments of the estimates—based, of course, upon the enhanced cost of doing work in London, due in no small measure to the action of the Council themselves.

The Duke thinks that the failure of the Works Department of the County Council has been conspicuous enough to check the further development of the policy represented by it. But it is by no means so clear as one might desire that this is actually the case. On the contrary, the Progressive candidates for election next month are citing the examples of extensive municipalization to be found in the provinces as supporting the argument for the usurpation of similar powers by the London County Council. The same party are offering to procure an additional source of revenue by taxing ground-rents and charging for "betterments"—if Parliament pleases. Unhappily, it is by no means easy to show "the man in the street" why the Progressive argument that "what is good for Birmingham, Manchester, or Glasgow should be as good for London," is more plausible than pertinent. Yet it is necessary that this process of conviction should be at least attempted, if London is to be saved from the rule of theorists of the Sidney Webb stamp. To begin with, the London County Council is not a municipality at all. That is to say, it is a new-fangled, artificial body, with none of the natural bonds binding it to its constituency that serve to keep truly local authorities in touch with the populace. Secondly, the argument that because a number of English towns have municipalized sundry public services, therefore the process is a desirable one, lacks logical force. What is wanted is proof that these things are well done—better, in fact, than they could be done by private enterprise. Readers of the "JOURNAL" do not need to be reminded that even the municipal supply of gas and water, instanced by the Duke of Devonshire as being a success in certain localities, has a "seamy side" which is not often displayed to the public view. Besides, the successful construction and administration of the gas and water undertakings of local authorities is dependent, in a greater degree than is generally recognized, upon the possibility of comparison with similar undertakings in private hands, and upon access to outside advice. Competition is the sole safeguard for efficiency in every living organism; and the possibility of comparison is only an indirect form of competition. These influences tend to keep municipalized undertakings from rotting, as they probably would do if left to themselves. Yet notwithstanding this preservative, it is as much as our trading local authorities can do to keep out of the clutches of the "Labour" politician, the shopkeeping interest, and the financial blood-suckers who are everywhere ready to fasten on the hand that holds the money. So far as it has gone, Municipalism in the United Kingdom is still upon its trial. From one point of view, this municipal life appears to have outgrown the old-fashioned rules of Mill and Cobden; but those who are wisest among us know that principles can only be tested by time. "Great is the Truth, and it shall prevail!" But the time may be long. Socialists, and Trade Unionists, and Progressivists are very clever and enthusiastic; and they think they can at short notice make a new world out of an old one, if only people will trust them with sufficient money. At any rate, they would like to try.

Fortunately, up to the present, the gas supply of London has not become a bone of contention between the aspirants for membership of the County Council. In reply to a question addressed to him at last week's meeting of the South Metropolitan Gas Company, Mr. George Livesey, the Chairman, declared that the prospect of the transfer of the gas supply of London into public hands was the remotest of all possibilities. At the same time, it is a possibility that may at any moment materialize itself, under favourable conditions. What these are, it is not our present purpose to describe. Some of them, it may be said are to be classified as natural; but those which are most likely to attract Progressive support are essentially artificial, or even hypothetical. Thus, we find one candidate saying: "With respect to the various monopolies which weigh so heavily on the progress of our city, and which, whilst depriving the municipal exchequer of its proper revenues, tax all for the benefit of the wealthy few, I hold that all such monopolies must be dealt with for the benefit of London's ratepayers." Mouth-filling platitudes such as these do not commit their user to anything, and certainly need not alarm anybody. So long as the enemies of the Gas and Water Companies keep to generalities, they may catch a few votes; but nothing else will happen.

The Storage of Calcium Carbide.—The use of acetylene and calcium carbide was recently investigated by the Board of Fire Commissioners of Jersey City, where a serious acetylene explosion occurred a short time ago. It has been decided to permit the use of certain generators, provided not more than 25 lbs. of the carbide are stored in a building at one time and this material is kept in 5-lb. block-tin vessels, hermetically sealed.

OBITUARY.

News has just reached us of the death of two old Lincolnshire gas managers—Mr. STOUT, late of Boston, and Mr. WOODWARD, late of Spalding. The former died in America (to which country he went on leaving Boston) on the 5th inst., as the result of an attack of influenza. He was in his 89th year, and retained all his faculties till the end. Mr. Woodward died at Spalding last Thursday afternoon. Both were deservedly respected in the district.

PERSONAL.

Mr. PERCY G. WINSTANLEY, of Nuneaton, has been appointed Manager of the Wolverhampton Gas-Works, in succession to Mr. Annan, whose resignation is referred to below.

Mr. J. C. MANN, who for several years has been engaged at The Gaslight and Coke Company's tar and ammonia works at Beckton, has accepted an appointment at the Hull works of Messrs. Major and Co.

Mr. A. J. YOUNG, the Manager of the Lockerbie Gas-Works, has been selected to fill a similar position at Louth (Lincs.), in succession to Mr. J. Cook, who has resigned. This appointment was advertised in the "JOURNAL" last month.

Mr. WALTER HOLE, of Rochester, has been selected by the Leeds Corporation Gas Committee for the position of Superintendent of Mains and Services, at a salary of £250 a year. There were 98 applicants for the post. The appointment is subject to confirmation by the City Council.

Mr. J. W. WYNNE, the Manager of the Milnthorpe Gas Company, has been appointed Secretary and Manager of the gas and water undertaking of the Ambleside Urban District Council, in succession to Mr. A. T. Fletcher, late of Leigh (Lancs.), who has resigned. Mr. Wynne will take up his new duties in about a fortnight.

With reference to the appointment of Mr. H. J. WILDIN, the Borough Accountant of Stoke-on-Trent, to the secretaryship of the Staffordshire Potteries Water Company, as noticed last week, the Town Council, in accepting his resignation, have ordered to be inscribed on vellum a resolution expressing their high opinion of the able manner in which he has, for a period of thirteen years, presided over the financial department of the Corporation.

Mr. J. ANNAN, the Engineer and Manager of the Wolverhampton Gas Company, has sent in his resignation, which the Directors have accepted; and it will take effect as from the 31st prox. In recognition of his long and valuable services to the Company, extending over 34 years, they have agreed to give him a retiring pension, on the understanding that his advice and assistance in the management of the business will be at their service. Mr. Annan will therefore still be in touch with what has been his life-work, while he will have more time to devote to those municipal and social questions which, as an Alderman, a Justice of the Peace, and a former Mayor of the borough, are necessarily of so much interest to him. He was one of the earliest members of the British Association of Gas Managers, and was a Past-President of the Midland District Association.

Mr. CHARLES DRU DRURY, Manager of the Hendon works of the Sunderland Gas Company, has been presented by the foremen and workmen with a handsome black marble clock and a silver tea and coffee service, on the occasion of his marriage with Miss Winifred Ritson, to whom they presented a gold curb bracelet. The clock bore the following inscription: "Presented to Mr. Chas. Dru Drury, on the occasion of his marriage, by the workmen of Hendon Gas-Works, Sunderland, Feb. 17/98." The gifts were handed over to Mr. Drury by Mr. J. H. Wright, Assistant-Manager; the presentation taking place in the meter-house at the works in the presence of a large gathering of the men. Mr. Drury, responding for Miss Ritson and himself, said it was most pleasing to him, filling a position of some difficulty, to find such excellent relations subsisting between the workmen and himself. He accepted the gifts as the expression of goodwill, which he should ever appreciate.

Proposed Reforms at the Local Government Board.—Some time ago it was deemed advisable to appoint a Departmental Committee to inquire into the sufficiency of the clerical staff and secretariat of the Local Government Board. The Committee have completed their investigations, and made their report. The document has not yet been published, but it is understood that the Committee are in favour of considerable augmentation. They hold that since 1884, when the question was last investigated, there has been an enormous increase in the work thrown upon the department, particularly by the Local Government Acts of 1888 and 1894. Their most important recommendations are that an additional Assistant-Secretary be appointed, raising the number of these officials to five; that the staff be strengthened by the addition of two principal clerks and two temporary Medical Inspectors; that an extra allowance be made to the Architect, to provide himself with such further assistance as he may require; and that twelve second divisional clerks be temporarily added to the establishment.

NOTES.

Gas Evolved by Trinidad Pitch.

In a paper "On the Nature and Origin of Asphalte," read by Mr. Clifford Richardson before the New York Section of the Society of Chemical Industry, he dealt with the above subject. It was shown in 1892 that the crude pitch in the Trinidad lake continued to evolve gas after it had turned quite hard, and also when it was heated and melted. This gas proved to be principally hydrogen sulphide and carbonic acid at the soft spot; and it seemed of interest to learn whether the same or other gases are evolved on heating. For this purpose some fresh pitch from the lake was placed in a flask and then heated in a bath—very gradually at first, and afterwards approaching the fusing-point. The evolved gas was at first all carbonic acid, and at higher temperatures all hydrogen sulphide. No other gases were found, and especially no marsh gas. The same gases are, therefore, evolved on heating the crude pitch as are found at the lake's centre; but hydrogen sulphide only at a comparatively high temperature. How much of each gas is derived from the water in the pitch, and now much, if any, from the reducing action of hydrocarbons on sulphates, or from splitting off of hydrogen sulphide by hydrocarbons in the act of condensation, has not yet been determined.

The Wear of Paving Materials.

Some instructive experiments designed to ascertain the comparative resistance to abrasion of different substances employed as paving materials are reported by the Boston "Journal of Commerce." In making these tests, an iron rubbing-wheel was used, and the samples were laid face downwards upon the wheel, which turned at the uniform rate of 75 revolutions per minute, and was well supplied with sharp sand and water. The blocks to which all the specimens were cemented were of equal weight, so that the rubbing was effected at nearly the same pressure in all cases. Under this treatment all marbles, and marble mosaics, wasted away very rapidly. Solid white Vermont marble lost ¾ inch in an hour. Most of the wood pavements resisted abrasion better than the marble; white fine wearing nearly twice as well as solid hard marble. Oak lost more in this way than pine. The material that best resisted this severe treatment was called "india-rubber tiling," which in an hour's rubbing lost only 1-64th of an inch of its thickness. Next to this, English encaustic tile gave the best results. The artificial stone known as "granolithic" came third. It is understood by highway surveyors, however, that rubbing tests do not afford conclusive indications of the value of paving materials, which also have to withstand the influences of the weather and the cutting action of hoofs and wheels.

Flat v. Sunk Keys on Gas-Engine Shafts.

Perfection, in mechanical engineering as in other handicrafts being made up of trifles, considerable interest attaches to a letter that recently appeared in the "Engineer" raising the question why the sunk key should be so generally used in preference to the key on the flat for general shaft and pulley work. The writer states that, up to moderately heavy work, the latter form of key is more satisfactory than the former. He instances the example of the fly-wheel of an ordinary gas-engine. If a flat is made on the shaft a little wider than the key, and the key is pushed home by hand only, for the sake of experiment, then it will be found that the key will not come loose while running though it may bump the first revolution, as it fastens itself. On the other hand, it is known that sunk keys in gas-engine fly-wheels often do come loose, no matter how well fitted or how tightly driven. The writer avers that he has himself keyed these wheels up with striking-hammer and stiff drift until he has been afraid of bursting the boss; and still they have periodically come loose, as testified by the disagreeable bumping noise caused by them. During considerable experience in shafting and general mill work, he has never seen a key on a flat come loose. The contention is that the key on a flat, if not absolutely tight at the time of keying up, will fasten itself and remain fast. Keys so fitted are cheaper, and do not weaken the shaft; but the sunk key appears to be a point of modern machine practice, adopted without sufficient reason.

A Welsbach Electric Light.

The report, which appears to have emanated from the "Neue Freie Presse," and has been circulated by the financial editors of many papers in this country, to the effect that Dr. Carl Auer von Welsbach has patented an incandescent electric light, will need much amplification before the gas industry will take alarm at the threatened addition to the resources of the rival industry of electric lighting. Unless the prevalent theory that incandescent gas lighting owes its economy to a catalytic action on the part of one or more of the rare earths be disproved, it is not easy to see what service the rare earths can render in electric lighting. The catalytic action of ceria can avail nothing if the phenomena of combustion are absent, as they are in the electric light. Dr. Bunte has shown that the rare earths of the Welsbach mantle have no extraordinary emissive power at high temperatures, if the phenomena of combustion are excluded, and that it is only by the peculiar power possessed by ceria, of lowering the temperature at which hydrogen and oxygen combine, that high local temperatures and intense radiation are produced by the mantle. This power would be absolutely valueless were hydrogen and similar combustible gases absent; and carbon, magnesia, or any refractory material would emit the same amount of light as the Welsbach composition, if merely heated to the same temperature. The catalytic theory of incandescent gas lighting is now fairly well substantiated by experimental evidence; and it seems highly improbable that the rare earths will ever benefit electric lighting to any considerable extent.

The Use of Coke for Steam Raising.

Some useful hints on steam raising and boiler management have been published by Mr. A. B. Mountain, the Borough Electrical Engineer of Huddersfield. Some of these observations touch upon the use of coke for this purpose, and illustrate the connection between different types of boilers and the most suitable fuel for their furnaces. The water-tube boiler is the lowest in price, and has the recommendation of being susceptible of forcing at a pinch. Its evaporative duty is high; but it needs to be kept clean. The Lancashire boiler, with economizer, is the most expensive plant of the kind; but it has its advantages. Mr. Mountain admits that, with hand-fired water-tube boilers burning coal, it is difficult to stop smoke. The flames rising from the fire come into contact with the cool tubes, and are to a great extent extinguished—thus causing smoke. "If coke can be bought at a reasonable price, excellent results may be obtained, and the smoke nuisance entirely removed; but coke has the disadvantage of requiring a very quick fire to stop the air rushing through, and a considerable quantity is usually thrown into the furnace when firing. This cools down the boiler, and reduces for a short time the generation of steam. Then when the charge is being rapidly consumed, the steam is generated at a very rapid rate." In default of coke, mechanical stokers are to be sought after. Of the two leading types of mechanical boiler stokers, the coking and the sprinkling, the former is the only one that is of any good for a water-tube boiler; whereas the latter will do quite well with the Lancashire boiler, and possesses the further advantage that the rate of firing can be varied within wide limits.

Utilization of Coal Tar Pitch in the Manufacture of Artificial Black Marble.—Artificial black marble is commercially made in the gas-works at Catania, Sicily. Common white sandstone is first cut into the desired shapes, and the various pieces are placed in a large iron tank, upon a heavy wire grating. Then, through an iron pipe, a stream of volcanic asphalte and coal-tar pitch, mixed in equal parts, is let into the tank from an adjoining boiler, until the molten mass fully covers the pieces of sandstone. The liquid is kept boiling in the tank for 36 hours; then the stones are taken out, placed upon a brick floor to cool and dry, and are afterwards polished in the same manner as other marble. The artificial product is said to resist acids; and it is not damaged by atmospheric action, moisture, heat, or cold.

Manchester District Institution of Gas Engineers.—The twenty-eighth annual meeting of this Institution will take place at the Grand Hotel, Manchester, next Saturday. According to the circular issued by the Hon. Secretary (Mr. S. S. Mellor, of Northwich), there will be rather more business than is usual at the first meeting in the year. Two new members will be proposed for election; and the various office-bearers will be chosen. The retiring President (Mr. R. Porter, of Elland) will introduce his successor, Mr. W. S. Haddock, of Warrington, who will deliver his Inaugural Address. Mr. H. Kendrick, of Stretford, will read a paper describing "An Experience with Dry Mains;" and Mr. H. Townsend, of Wakefield, will present another, entitled "Emergencies." At the close of the business, the members will take tea together.

Midland Association of Gas Managers.—As notified in the "JOURNAL" a fortnight ago, the annual meeting of this Association will take place in Birmingham next Thursday. We learn from the circular issued by the Secretary (Mr. C. Meiklejohn, of Rugby) that the business will be transacted at the Grand Hotel. It will comprise the presentation of the Committee's report and statement of accounts, the election of new members, and the delivery of the Inaugural Address of the President, Mr. J. T. Lewis, of Wellingborough. Mr. T. Glover, of West Bromwich, will introduce the subject of acetylene gas, and give a description of a generator made by Messrs. Read Holliday and Sons, Limited, of Huddersfield; and a circular-letter from the North British Association of Gas Managers on the standardizing of meter unions will be considered. At the close of the meeting, the members will take tea together.

Advice to Boiler Attendants.—The Manchester Steam Users' Association have issued a large sheet bearing the name of the Chief Engineer of the Association (Mr. C. E. Stromeyer, M.Inst.C.E.), and headed "Advice to Boiler Attendants." This course has been taken in view of the recent annual report of the Board of Trade on boiler explosions, in which complaints are made of the negligence shown by boiler attendants. The notice gives, in the first place, some leading points as to the general working of boilers; and, under the heading "Warnings," it next furnishes some precise instructions as to what a fireman should do when he has neglected his duty. Hitherto he has been left to rely on his own judgment and resources whenever he has found himself face to face with a threatened explosion, so that the advice now given, and intended for posting up in the engine-house itself, should be of much practical utility.

TECHNICAL RECORD.

DR. BUNTE ON INCANDESCENT LIGHTING, ACETYLENE, AND THE DEVELOPMENT OF FLAME ILLUMINATION.

The following is an abstract-translation of a lecture delivered by Dr. H. BUNTE, of Carlsruhe, at the annual general meeting of the German Association of Gas and Water Engineers, at Leipsic, in June last year. The text of the lecture was published in a recent number of the "Journal für Gasbeleuchtung."

Luminous flames were regarded for centuries after Prometheus, according to tradition brought fire from heaven, as objects of worship rather than as a means of illumination; and every care was bestowed on the configuration of the lamps, while no attempt was made to improve the feeble flame they furnished. Only towards the close of the eighteenth century did a better knowledge of the principles of combustion afford the basis for an actual advance in illumination by means of flame. The position of artificial lighting at that time was well indicated by Goethe, who declared that the highest achievement was candles which burnt without needing snuffing. But with the present century was introduced by Murdoch lighting by flame without the medium of a wick; and from Watt's Soho Factory, gas-lighting rapidly spread through England. Between 1820 and 1830, it was brought to the chief German towns; and for more than half a century afterwards lighting by gas or petroleum flames held almost universal sway. Towards the end of the seventies, there appeared the electric light, which was without flame or combustion, as the rival of flame-lighting by combustion, which in contradistinction may be termed the chemical light. The rivalry of the two descriptions of light has resulted in the world being provided with artificial illumination on a scale of which earlier generations had no conception.

The lecture deals with the developments in flame illumination during the last twenty years; and a few words must first be devoted to the more important advances in the manufacture of illuminating gas. Of these, the most stupendous is the introduction of gaseous firing for heating the retorts; and this was the precursor of the change from horizontal to sloping retorts—an alteration scarcely practicable had direct firing only been possible. In almost all the other apparatus of a gas-works great improvements have been made; and special attention has been given to the complete recovery and utilization of bye-products. Another industry—viz., that of coke production—has profited by the experience first gained in gas-works, and has applied gas to the heating of the furnaces, and taken up the recovery of tar and ammonia, and quite recently that of benzol also. The illuminating value of the gas from coke-ovens is of no moment, and therefore the benzol is scrubbed from it by means of oil; and thus ten times as much benzol is obtained from the coal as could be recovered from the tar alone. Hence, notwithstanding continually increasing demands for benzol, the coke-oven production has flooded the market, and reduced the value of this product. The increased production and cheapening of the most important illuminant of gas-flames do not, however, react wholly to the disadvantage of the gas industry; for a method of partial synthesis of illuminating gas, based on the addition of benzol vapour to feebly-illuminating gas, thus becomes possible, and the gas engineer is made independent of scarce and dear gas-making coal. In America, the last decade has witnessed a development in gas manufacture of a different order. The abundance of petroleum has led to the introduction of water gas rendered illuminating by the products of the decomposition of this oil; and the so-called carburetted water gas thus manufactured has become a powerful competitor with coal gas in England and other European countries where petroleum is not subject to import duty.

Davy, in 1819, promulgated the theory of luminous flames which is substantially that now held; and more than half a century elapsed before new conceptions led to any considerable development in illumination by flame. In the seventies, however, F. Siemens applied the regenerative principle, which had produced splendid results in the art of heating, to luminous flames; and burners were produced which enabled gas to compete successfully with arc electric lights, which then threatened to displace entirely the old illuminant for certain uses. The introduction of the incandescent electric light in 1881, brought a competitor in a field which previously had been almost reserved for gas; and the possibility of multiplying the number of incandescent electric lamps used in a room, and thus increasing the illumination to an unlimited extent without an appreciable production of heat, led to prophecies to the effect that gas would soon only be used for heating purposes. But the intense heat afforded by gas when burnt in the bunsen, furnished new means of utilizing it for lighting purposes; and in conjunction with skeleton-like structures composed of certain rare earths, the bunsen rendered gas lighting the cheapest means of illumination for ordinary conditions. The spirit of invention was stimulated by the success of the Welsbach discovery; but empiricists failed on ground which needed high scientific attainments for its useful study. At present, all the incandescent mantles of practical value consist essentially of the oxides of thorium and cerium.

The question of the source of the high illuminating power of incandescent mantles remained almost entirely unconsidered in the scramble for immediate practical results. It was deemed adequate treatment of the matter to ascribe to the rare earths a special power of light emission, or of radiating much light at relatively low temperatures. But this only evaded the real issue, and in no way elucidated the problem. The various attempts to explain the remarkable phenomenon—such as those of Lewes, by the transition of the constituents of the mantle to a crystalline condition, and of Drossbach, by a special resonance to waves of light possessed by the rare earths—were quite unsatisfactory. It was known from the first that only particular mixtures of the rare earths had a peculiarly high power of emitting light; but the acknowledgment of this fact did not further its explanation. The ascription to mantles of a contact or catalytic action, by Killing,* demanded also the admission of a peculiar power of light emission for the elucidation of their high luminescence. But it was never proved whether or no the rare earths or the mixtures of them had a greater capacity than other bodies of becoming incandescent at relatively low temperatures. In a short communication to the German Chemical Society, in April, 1896, the author expressed the view that no special power of emitting light, but only a very high temperature, as with ordinary luminous flames, was the cause of the intense luminous effect. Further research has confirmed the conception then promulgated; and the author will now attempt to set forth the theory of the incandescent gas light.

In the manufacture of mantles, fine, carefully-purified gauze is saturated with a solution of nitrates of the rare earths; and the dried mantle is stretched over a cylindrical piece of wood, and subsequently hung up on an iron wire. The upper part is heated with a bunsen flame, and a white ash-like skeleton is obtained, which is hardened in the blow-pipe flame. Since useful mantles consist substantially of from 98 to 99 per cent. of thorium oxide, and from 1 to 2 per cent. of cerium oxide, the gauze is impregnated with a mixture of thorium and cerium nitrates in such proportions that the residue on incineration has the above composition. It is a curious fact that a mantle of pure thorium oxide will emit only a feeble blue light of about 2 candles intensity, and one of pure cerium oxide a reddish light of about 6 candles. But these oxides mixed in the above proportions give the well-known Welsbach mantle, which will emit a light of 50, 70, or even more candles. No addition to the luminous effect results from any increase in the percentage of cerium oxide. If some peculiar power of emitting light possessed by the above mixture were the cause of its remarkable behaviour, then proof thereof would easily be afforded by the great difference which there would be between the illuminating power of the pure earths and of the mixture, if the intensities of the radiation were compared with those of other well-known bodies—such as carbon, magnesia, &c.—when all the phenomena of combustion were excluded.

In order to settle this question experimentally, a thick-walled tube of arc carbon, having the walls of its middle portion reduced for a length of 4 inches to a thickness of 0·059 inch, was heated by a powerful electric current until the middle portion attained a most intense white heat, far above 3630° Fahr. In order to prevent combustion and loss of heat, the middle of the tube was embedded in magnesia, over which asbestos paper was wrapped. Small square prisms (0·59 inch long, by 0·28 inch wide) of magnesia were coated with the substances to be examined; and each was cemented to a similarly-shaped piece of carbon or magnesia, so that the two adjoining faces consisted of the two substances to be compared. On placing these double prisms in the tube, it was possible, with certain precautions, to observe the relative intensities of the radiation by comparing the two halves of the surface visible in the tube. Dr. Eitner carried out these researches, which showed very small differences in the intensity of the radiation from carbon, magnesia, pure oxides of thorium and cerium, and the Welsbach mixture. Evidence was thus obtained that the high illuminating power of the incandescent mantles cannot be explained by a peculiarly high power of emitting light; and therefore the explanation was sought in other causes.

The catalytic or contact action of the rare earths has been mentioned already. It implies accelerated combustion of the molecules of gas on contact with the mantle, and consequently an increased flame-temperature at the mantle, which heats it to intense incandescence. The mantles, in fact, exhibit, as Killing has shown, such catalytic effects; and a Welsbach burner, after extinction, will, if the tap is opened a little later, re-ignite the gas, through the combustion induced in the mantle bringing it to incandescence. A trace of platinum or iridium in the mantle favours this phenomenon. On investigating the oxides of thorium and cerium, with a view to learning if they displayed a contact action which quickened combustion, it was found that thorium oxide had no influence on the combustion of hydrogen and oxygen. Ignition took place at 1200° Fahr., whether the tube contained thorium oxide or silicic acid, or was empty. Cerium oxide, however, induced combination at about 660° Fahr. —or, in other words, it lowered the temperature of ignition by about 540°. It constrained hydrogen and oxygen to unite under conditions in which otherwise they would have remained in contact without combining. It can be assumed that cerium oxide will exert the same action in the flame as at lower temperatures. It will cause a rapid and vigorous combination

* See "JOURNAL," Vol. LXVIII., p. 1128.

of hydrogen and oxygen; and, by the combustion of the previously warmed gases, it will produce an extraordinarily high temperature, by which the oxide will be brought to the most intense incandescence. From this, it would be anticipated that a mantle of pure cerium oxide would be the best; but experiment shows that such is not the case.

The explanation of this contradictory behaviour is afforded by a phenomenon which is best observed in the case of platinum. This metal, in the form of platinum sponge, displays powerful contact effects; but if a platinum gauze mantle is brought into the bunsen flame, it glows only moderately, and does not exhibit strong luminescence. The temperature of the hottest part of the gauze is far below the melting point of platinum; but if a capillary platinum wire is put in the flame, it can be readily melted in places, though the necessary temperature is about 3270° Fahr. In this case, the thinness of the wire retards the rapid conduction of heat by it, and the maximum temperature of the flame comesinto play; while the conductivity of a thicker wire, or of gauze, prevents the full temperature taking effect at distinct points, and rapidly equalizes the temperature to a moderately high one which prevails uniformly over the whole of the gauze. If it were possible to insulate—as in the case of the capillary wire—catalytic substances, such as platinum and oxide of cerium, in the flame, by distributing them in a state of fine subdivision over a feeble conductor of heat, then points of maximum temperature would be secured in place of an average temperature, and powerful luminous effects would be obtained. In Welsbach mantles, the thorium oxide enacts this part of an insulating frame for the support of the active material. It is obtained from the nitrate, on incenerating the mantle, as an extremely fine filamentous swollen mass. A simple experiment shows how different is the behaviour on heating the nitrates of cerium and thorium. On decomposing cerium nitrate, the oxide is obtained as a slightly porous mass; whereas thorium oxide is a voluminous mass as just described, and, indeed, swells up like mercuric sulphocyanide (well known as "Pharaoh's serpents"). In incinerating the nitrates as in the manufacture of Welsbach mantles, the particles of cerium oxide become distributed on the millions of fine fibres of thorium oxide; and in this state of subdivision, they attain in the mantle of the bunsen flame a very high temperature, far exceeding 3600° Fahr. There is thus produced a blinding blaze of light, because the intensity of the light increases approximately with the fifth power of the temperature.

The objection might be raised that the small quantity (about 1 per cent.) of cerium oxide in the Welsbach mantle is much too small to account for the extraordinary intensity of the light when compared with the feeble light from a mantle of pure thorium oxide; but a little consideration of the conditions obtaining in an ordinary luminous gas-flame, will dispose of this objection. According to Davy's theory, the illuminating power of an ordinary gas-flame is due to the particles of carbon which are separated from the gas and raised to a white heat. The carbon arises chiefly from the decomposition of the heavy hydrocarbons, ethylene and benzene, which form together about 5 per cent. of the volume of the gas. Assuming, for the sake of simplifying the calculation, that all the carbon of the benzene and half that of the ethylene are separated and heated to incandescence in the flame, it may be calculated that about 54 milligrammes of carbon are separated from a litre of good coal gas (23·6 grains from 1 cubic foot). Thus 4 per cent. of ethylene and 1 per cent. of benzene give, per litre of gas, 60 c.c. carbon vapour from the benzene, and 40 c.c. from the ethylene—in all 100 c.c., which is equivalent to about 54 mg. carbon. The volume of the luminous portion of a flame having a consumption of 5·297 cubic feet per hour, and an illuminating power of 17·5 candles, is about 2 c.c. at 32° Fahr. There is therefore in it $\frac{2 \times 54}{1000}$ mg., or 0·1 mg. (0·0015 grain) of incandescent carbon. Such an extremely small quantity of incandescent carbon as 0·0015 grain, gives the luminous surface to the gas-flame, and emits a light of 17·5-candle power. Now the 1 per cent. of cerium oxide in the Welsbach mantle amounts to about 4 mg. (0·06 grain) per mantle, or about 40 times the quantity of incandescent carbon in an ordinary flat flame. The quantity is therefore quite sufficient to explain why the Welsbach burner may give a light of 60 candles, while the flat-flame or argand burner furnishes only 17·5 candles.

The thorium oxide contributes to the illuminating power to the same extent as do the hydrogen, methane, and carbonic oxide, which form 95 per cent. of coal gas, to the illuminating power of the flat flame. It is of importance for developing light from the cerium oxide, a mantle largely consisting of which is as inefficient as is gas surcharged with hydrocarbons in the ordinary burner. The skeleton of thorium oxide remains inactive, and does not cause the intense combustion which is concentrated on the particles of cerium oxide, which are thereby raised to a white heat. If the thorium oxide exerted the same contact action as does the cerium oxide, the combustion would be distributed over the whole substance of the mantle; and only a moderately high uniform temperature would be reached, and a feeble incandescence obtained. From 1 to 2 per cent. of cerium oxide in the incandescent mantle suffices to combine the particles of unconsumed gas and oxygen in the bunsen flame; and any greater amount is objectless, or even injurious, as the dispersion of the cerium oxide is diminished. According to this view, the incandescent gas-light resembles the ordinary gas-flame. In the latter, the particles of carbon are first separated from the gas, become strongly luminous at the moment of combustion, and are consumed to carbonic acid; while in the incandescent light, combustion occurs on a refractory substance which is able to radiate light continuously. By continued use, the mantles lose efficicency, partly through fine particles of thorium oxide being abraded, and partly through the conductivity being increased through the fritting of particles of atmospheric dust with the substance of the mantle.

It is impossible to say whether the rare and costly oxides of thorium and cerium can be replaced by other substances more readily obtainable; but the choice at present is very limited. We know very few substances which are infusible and refractory at the high temperature of the flame, and which could be obtained in a simple manner in a sufficiently fine state of division. The author is not aware of any materials which can be substituted for these two oxides with advantage; but perhaps a better knowledge of what takes place in the incandescent light flame may give point to further inquiries.

Advances in incandescent gas lighting may take another direction—that is to say, the burners may be improved. The above exposition shows that *cæteris paribus* the illuminating power depends on the intensity of the combustion at the particles of cerium oxide in the mantle. It is therefore essential that a sufficient quantity of air for complete combustion should be present in the zone of the mantle. The 2 to 2½ volumes of air drawn into the bunsen by the gas suffice to disillumine the flame, but are barely half the quantity required for complete combustion. Therefore air must diffuse from outside into the flame, as in the ordinary gas-flame. The diffusion is greatly facilitated by the opening at the top of the later pattern of mantles, which enables the gaseous products to escape, and air to pass in. This pattern thus gives much better results than did the old form of mantle with closed top. An attempt has been made to facilitate the inflow of air to the flame by admitting it through lateral holes in the chimney; and Jena chimneys with lateral perforations give a considerably higher illuminating effect.* Finally, the intensity of the combustion in the mantle zone, and consequently the illuminating power, rise the more molecules of detonating gas reach the mantle and are burnt in the same time. This rise is achieved by the use of either gas or air or both air and gas under pressure, or of an intimate mixture of gas and air as in the Bandsept and other burners. Evidently the incandescent light can be secured from other fuels than coal gas—such as non-luminous water gas and vapour of spirit and petroleum—and some good results have been obtained with them. Many automatic igniting appliances have been introduced, with the object of abolishing the use of matches for lighting incandescent gas-lamps, and thus to place the latter more nearly on an equality with the electric light in respect of ease of ignition and extinction.

(To be continued.)

GAS-ENGINE RESEARCH.

At the Meeting of the Institution of Mechanical Engineers on the 11th inst.—the PRESIDENT (Mr. S. W. Johnson, of Derby) in the chair—the first report of Professor FREDERIC W. BURSTALL, of Birmingham, to the Gas-Engine Research Committee was read by the newly-appointed Secretary (Mr. E. Worthington).

Professor Burstall commenced his report by stating the object of the experiments he had conducted—viz., to determine the effect produced on the economy of gas-engines by altering one or more of the conditions governing their working. The factors to be considered in such an investigation are the amount of compression, the speed, the ratio of air to gas, and the quantity of heat which is to be rejected through the walls of the cylinder. For example, an increase of compression is often regarded as conducive to more economical results. But it is uncertain whether the attendant increase in economy is really due to the compression alone; for it is clearly impossible to state with certainty the cause of any such economy, unless the conditions of working are altered successively one at a time. All the published results of tests made on gas-engines are based upon only one fixed set of conditions which have been arrived at by the makers in a more or less empirical manner. This dearth of information is no doubt due to the fact that gas-engines have not hitherto been made for experimental purposes, and that it is difficult to get any reliable results when an ordinary gas-engine is tried under conditions but little removed from those of normal working. For this reason it was decided to employ in these experiments an engine of rather small size, which was specially constructed for experimental purposes. It was, of course, known that the absolute economy of such an engine would be inferior to that of a larger one; but there seemed no reason to suppose that the comparative economies effected would be under varying conditions different in the two sizes. Moreover, had the engine been of larger dimensions, it would have been impossible to measure with precision certain of the quantities, such as the volume of air. All the measuring instruments employed in the experiments were calibrated by

* See "JOURNAL," Vol. LXIX., p. 77.

comparing them with some standard the accuracy of which was not open to doubt.

The engine employed was one of 2-horse power nominal; but it was capable of developing a maximum of 5 indicated horse power. It was built by Messrs. Fielding and Platt, of Gloucester, who altered it so as to adapt it for experimental purposes. It was of the ordinary horizontal kind, having a cylinder 6 inches in diameter and 12-inch stroke. The whole of the valves were placed at the bottom of the cylinder, and worked in the ordinary manner by means of cams on the lay shaft. The governing was effected by an ordinary Watt governor acting on a small roller, which caused a charge of gas to be cut out when the speed was too high. The variation in the speed was produced by altering the weights on the governor; the engine being capable of running at any speed between 120 and 205 revolutions a minute. At the lower speed, the single fly-wheel was not sufficiently heavy to enable the engine to run steadily; and therefore the results of tests made at this speed were not so satisfactory as those made at a higher one. The compressions employed in the experiments varied between 35 and 90 lbs. per square inch. The variation in the quantity of gas admitted per charge was effected by throttling the gas as it entered the cylinder.

The most usual method of determining the amount of gas consumed in gas-engine experiments is to employ a wet test-meter. This is a satisfactory arrangement as far as measurement is concerned; but it has the disadvantage of not controlling the fluctuations of pressure which occur. A calibrated gasholder was therefore adopted. It was 6 feet in diameter, and had a working stroke of about 3 ft. 4 in., with a consequent capacity of about 100 cubic feet, which was sufficient for the requirements of a single test. The advantage attending the use of the holder was that the pressure was perfectly constant from start to finish; and a single sample of gas taken from it was identical in composition with that used throughout the test. As a means of measurement of volume, the holder was accurate to 0·1 of 1 per cent. Special care was taken to prevent any leakage of gas either in the holder or in the supply-pipes; and the use of the holder rendered it easy to determine whether or not leakage existed. In order to determine the quantity of air employed per stroke, it was considered advisable to measure it, instead of deducing it by calculation. Although the direct measurement of the air supply is usually considered a difficult, and somewhat dangerous, undertaking, no trouble was experienced by the experimenters. The pressure and temperature of the air were measured by means of a gauge and thermometer. The meter was checked by blowing air through it into the holder; and it was found to be correct to 0·5 of 1 per cent. In determining the composition of the exhaust gases, difficulty is usually experienced in getting a true sample. The gas is generally drawn from the exhaust-pipe during the test, and contains, in addition to the gases discharged from the cylinder, a quantity of air which comes when a miss-fire occurs. The method adopted in the present experiments was to take a single bubble of gas from just below the exhaust-valve after each explosion stroke.

The next matter dealt with in the report is the measurement of the indicated horse power of the engine. The indicators usually employed in gas-engine tests are the Richards, Crosby, Darke, Tabor, and Wayne. After considerable experience in the use of all of these, the rotary Wayne indicator was selected. The singular feature of this instrument is the rotating piston, which is employed in place of a reciprocating one. The rotating piston does not touch the containing cylinder at the outer extremities of the piston, but is guided in the centre in circular bearings. The piston friction is therefore due only to the friction in these bearings, and is consequently small, and not liable to change, because the bearings can be well lubricated, and are not liable to have the oil swept off their surface as is the case with the piston of an ordinary indicator. For reducing the pencil friction to a minimum, and for preventing any change in the dimensions of the diagram, paper of any kind was discarded, and was replaced by a thin sheet of mica thinly coated with smoke. The tracing-point which was made of a hard drawing-pencil, moved almost without friction over the smooth surface of the mica, and cut away the smoke wherever it touched the mica. For preventing the smoke from being rubbed off, the diagram was protected with a varnish composed of colourless lacquer diluted with alcohol. This was poured upon the mica, and, after the excess had been drained off, was set by gentle heat. Though the diagrams varied but little, it was deemed advisable to construct a mean diagram to represent the whole of the set taken during the test.

The method adopted by the makers of the engine for igniting the charge was an iron tube heated by a gas-flame. In so small an engine there is not usually a timing-valve; and the correct time of firing is regulated by heating a longer or shorter length of the iron ignition-tube. Some form of timing-valve, however, seems absolutely necessary in all sizes of gas-engines; and for economical and smooth running the time of firing has to be determined with great precision. In default of a timing-valve, it was decided to attempt to ignite the charge by means of an electric spark, as it was hoped that electric ignition would prove more certain and precise than any form of hot-tube igniter. The reporter's endeavours to obtain a precise and certain ignition by means of a secondary spark ended in failure; and the method of ignition finally adopted was by means of the ordinary iron tube, to which was added a timing-valve worked electrically. This, however, was regarded as only a temporary arrangement, because the life of iron tubes is so short, while with tubes of porcelain and numerous metallic alloys the ignition is not so prompt as with iron tubes.

Analyses of the gas used were made by Mr. G. N. Huntly, B.Sc., who supervised the analyses of the exhaust gases. The composition of the coal gas is given below; the results being stated in percentages of volume:—

	Sample 1.		Sample 2.
Carbon dioxide	—	..	—
Heavy hydrocarbons	4·4	..	4·7
Oxygen	0·2	..	1·2
Carbon monoxide	4·8	..	7·0
Methane	36·2	..	34·4
Hydrogen	46·7	..	45·8
Nitrogen (by difference)	7·7	..	6·9
	100·0		100·0

The calculated volume of air required to burn one volume of gas into carbon dioxide and water was 5·61 in sample 1, and 5·47 in sample 2. The heating values per pound of gas were 18,817 and 17,811 British thermal units respectively.

The principal results of the seventeen experiments that were carried out are shown in the tables given on the opposite page. The ratio of air to gas was obtained by direct measurement, and was corrected for the quantity of air left in the clearance space. The usual method of finding this ratio is to assume that the cylinder and clearance space are filled with air and gas at an assumed temperature and at a pressure given by the diagram showing the suction stroke. In the case of the present trials, this method would have given a result about 15 per cent. too large. In finding the thermal efficiency, the mechanical equivalent of heat was taken as 778 foot-pounds. The mechanical efficiency of the engine varied from 76 to 84 per cent.; the mean value for the whole seventeen tests being 81 per cent. Trial No. 15 was a full-power test of the engine when running at 197 revolutions per minute. In all the other tests, the dead load on the brake was constant. Considering the three low-speed tests, Nos. 1, 13, and 14, the most economical result was in test No. 13, in which the ratio of air to gas was 10·4. Although test No. 14 has double the compression of test No. 1, the two were nearly equal in economy. All three tests were distinctly uneconomical. Taking the remaining results at speeds of about 160 and 204 revolutions per minute, the most striking feature shown is the importance of selecting a proper ratio of air to gas. It would seem probable that the influence of increased compression on economy is due to the fact that weaker charges can be burnt completely during the stroke when the compression is high. Considering tests Nos. 4, 8, 9, and 16, in which the ratio of air to gas was about 7·14, the thermal efficiencies were nearly the same; and the lowest in test No. 16 occurred with the highest compression. The most economical results, except test No. 15, were in Nos. 7 and 17, where the ratios of air to gas were 9·48 and 10·8 respectively. Test No. 6 cannot be considered as comparing with the others, because the shape of the indicator diagrams shows that the gas was igniting too late in the stroke. Test No. 12 is interesting, as showing the result of employing a very rich charge. Test No. 15 gives the thermal efficiency of 21 per cent., which is a very high figure when the small size of the engine is taken into account. Moreover it seems probable that more economical results than this could be obtained, as the ratio of air to gas was 8·6, which is certainly higher than necessary. The tests seem to indicate that economy depends on the choice of the correct ratio of air to gas, and that this ratio increases with the compression. The reporter states that the number of experiments is not yet sufficient to determine what this ratio is for any given compression; but it is intended to make a sufficient number to determine this important point.

Discussion.

The PRESIDENT, before inviting discussion, read a letter he had received from Professor Kennedy, who was the Chairman of the Gas-Engine Research Committee, and who was unable to be present.

Professor KENNEDY, in the course of his communication, said he thought the investigations were among the most important and interesting which had yet been undertaken by any Committee of the Institution. About eleven years ago, in connection with some gas-engine tests which he had to carry out, he endeavoured to make a heat account of the tests of a similar kind to those heat accounts with which engineers were familiar in the case of steam-engine trials, and which had proved to be of so much use. In other gas-engines trials, including the Society of Arts motor trials in the year 1888, he also adopted this method of working. At that time, they had no thermometric instruments of such a kind as would enable them to make measurements of temperature in a gas-engine with any approach to certainty or accuracy. The conditions of the case also, and above all questions of expense, rendered it impossible to make positive determinations on many points of the greatest importance—much had to be estimated or calculated. Notwithstanding all these drawbacks, the results proved themselves, he believed, of considerable value. Although the actual figures were only approximately correct, yet he had the satisfaction of finding, by experience, that they were sufficiently near the truth to be of practical use in arriving at causes of defective working of gas-engines in practice. Ever since the time he mentioned,

No of Test.	Compression per Square Inch, Absolute.	Clearance ÷ Cylinder Vol.	Revolutions per Minute.	Explosions, Ratio of Actual to Maximum Possible.	Indicated Horse Power.	Gas Per I.H.P. per Hour.	Heat Expended.		Thermal Efficiency.
							Per I.H.P. per Hour.	Per Explosion.	
	Pounds.	Ratio.		Per Cent.		Cub. Feet.	Th. U.	Th. U.	Per Cent.
1	52	0·57	118·0	89	1·72	33·00	20,122	13·61	12·60
2	62	0·49	161·0	50	2·65	25·60	15,698	17·20	16·20
3	64	0·49	158·3	58	2·69	25·90	16,517	16·20	15·50
4	64	0·49	164·3	52	2·79	27 30	16,557	18·15	15·40
5	65	0·46	204·4	67	3·71	26·90	16,300	14·95	15·60
6	65	0·46	204·2	88	3·41	32·10	18,975	11·96	13·40
7	72	0·41	156·2	64	2·87	23·30	14,111	13·46	18·00
8	74	0·41	158·2	53	2·44	29·70	17,964	17 30	14·40
9	76	0·36	157·7	55	2·61	27·70	16,706	16·80	15·24
10	80	0·36	155·5	69	2·61	24·05	14,460	11·76	17·65
11	83	0·37	154·2	69	2·50	26·55	15,548	12·20	16·40
12	83	0·37	154·9	61	2·52	35·10	21,663	19·30	11·70
13	85	0·37	117·6	75	1·84	28·20	17,041	11·90	15·00
14	102	0·25	117·7	78	1·60	31·10	18,734	10·85	13·60
15	103	0·25	197·2	92	5·10	20·35	12,186	10·95	21·00
16	105	0·25	157·5	70	2·48	30·28	19,018	14·27	13·40
17	105	0·25	148·9	85	2·56	23·80	14,171	9·58	18·00

No. of Test.	Temperature of Jackets in Degrees.		Heat Given to Jacket per Explosion.	Vol. of Air ÷ Vol. of Gas.	Max. Pressure in Cylinder per Square Inch, Absolute.	Composition of Exhaust Gas.			
						By Analysis.		By Calculation.	
						Carbonic Acid.	Oxygen.	Carbonic Acid.	Oxygen.
	C.	F.	Per Cent.	Ratio.	Pounds.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
1	61·0	141·8	28·6	9·10	118	6·0	10·0	6·3	8·10
2	62·7	144·9	35·0	8·00	211	7·6	6·4	7·2	6·40
3	64·7	148·5	31·8	8·36	171	7·2	7·4	7·1	7·76
4	63·5	146·3	41·5	7·13	203	8·0	5·2	8·2	5·00
5	64·5	148·1	37·1	8·35	167	7·2	7·6	7·0	8·00
6	60·8	141·4	28·5	8·48	105	7 2	7·6	7·0	7·95
7	62·7	144·9	37·2	9·48	171	6·0	9·6	6·0	8·60
8	66·0	150·8	45·2	7·18	237	8·2	5·6	8·1	4·70
9	65·0	149·0	42·8	7·08	230	8·2	5·8	8·2	5·60
10	71·3	160·3	40·6	10·10	161	5·2	10·8	5·1	9·00
11	56·5	133·7	41·8	8·75	203	6·5	7·0	6·6	7·80
12	75·6	168·1	30·9	5·28	286	9·3	0·4		*
13	60·0	140·0	41·5	10·40	179	6·2	9·4	5·6	10·50
14	60·8	141·4	42·6	9·25	210	5·4	10·6	6·4	9·10
15	62·0	143·6	35·4	8·60	201	6·8	8·6	6·9	8·10
16	59·0	138·2	32·8	7·18	278	7·4	6·6	8 3	5·40
17	67·0	152·6	29 0	10·80	135	3·6	11·6	5·4	10·90

* Could not be calculated, owing to insufficiency of air.

he had hoped that someone more fortunate than himself, and with better appliances, might be able to carry out similar tests with something like really scientific accuracy. He proceeded to speak of the patient labour which Professor Burstall had bestowed on the perfecting of the instruments which were employed in these investigations. Continuing, he said the point which had been specially present in his mind as to these experiments was that they should enable the Committee to present the results of gas-engine working in the form of a heat account, such as that introduced many years since on the Continent by Hirn for the steam-engine, and independently adopted in this country, at a somewhat later date, by Sir Frederick Bramwell. In connection with the experiments described in the report, a great many temperature measurements had been made. It had not yet, however, been possible to complete the working out of these; so that the preliminary experiments were not stated as complete thermal experiments—the question of temperature not being dealt with at all. It had been left for a second report to describe the methods and apparatus finally used in the determination of the temperatures, and to deal with the thermal working out of the gas-engine trials. From the results already in their hands, he had no doubt that Professor Burstall would be able to show as complete a heat balance in connection with a gas-engine test as those with which engineers were familiar in the case of the steam-engine. He believed that this would be one of the most important pieces of work in what he might call "thermal engineering" which had been placed on record.

Professor Burstall said he should like to explain that he had not entered into full details in the report regarding the correction that had had to be made for error in the indicator multiplying mechanism. Any form of this mechanism would not have a constant multiplication; so that this had been allowed for in the final plottings. Since these experiments were made, a considerable number of other experiments on exactly the same lines had been carried out. They served to show very exactly that one could determine the ratio of air to gas without using an air-meter, and that this could be done by an accurate analysis of the exhaust gases. It was simple, and certainly a more correct method than the usual way of estimating it by difference in the engine cylinder. He hoped to produce evidence sufficient in the next report to prove this point conclusively. The engine as now erected had two fly-wheels; whereas before it had only one. The reason why the thermal balances had not been given was not because they were not worked out, but because it was considered that the thermal side formed a separate branch to the part that was considered in the report, which really dealt with the economy of the engine under relative conditions.

Mr. Dugald Clerk (London) said he was sure all engineers who were engaged in designing and constructing gas-engines were exceedingly indebted to the Institution for having taken up this subject. Of course in ordinary work, it was impossible to use the refinements that Professor Burstall had so well described. Important results, however, must follow his careful and accurate work; and no doubt in time he would arrive at some better understanding of the conditions of economy in gas-engines. So far, the experiments seemed to him (Mr. Clerk) to have been conducted with perhaps insufficient experience of the most important point to be dealt with in these matters—that was, the engine itself. Professor Burstall had gone with great care and minuteness into the questions of the indicator, thermometer, the proportion of gas and air, the temperature of the entering air, and so forth; and no doubt he had given, with great accuracy, the proportion of the heat balance to which Professor Kennedy had referred. But they required to get more than the heat balance to get the conditions of economy in a gas-engine. It depended entirely upon the engine used as to whether economy was diminished by increasing the compression. They could take a gas-engine so constructed that increasing compression would produce a positive diminution of economy. Take, for example,

the old "Otto" engines as introduced about 1877. In those old engines, the proportion of the port capacity to the compression space was very large—it was as much as 25 per cent. He began his gas-engine work in 1876; and in 1878 or 1879, Messrs. Crossley attempted to increase the compression. But it was found that an increase in compression in these old engines meant not an increase, but a diminution, of economy. In those days, the pressure was 35 lbs. per square inch; but if they raised it to 90 lbs. per square inch in one of the old engines, they had a drop in economy instead of an increase. The engine used in the tests described by Professor Burstall appeared to him (Mr. Clerk) to be one that was not suited to carry out experiments of this class. They got a heat balance no doubt; but they got an especially bad heat balance with high compression—for this reason, that the liner, which was pushed into the compression space, so far as he could see, would produce an annulus. If the piston passed in, and the projection passed beyond the end of the liner, they would have an annulus formed, which was peculiarly bad, and which increased the fuel consumption at high compression. In the case of an engine working at 35 to 52 lbs. compression, if they took the same engine and increased the compression by simply pushing in the piston, unless certain precautions had been observed in constructing the engine, they would not get an economy in proportion to the increased compression, but would get low economy, and sometimes an actual loss. He could not tell why it was one way or the other without testing it. They must, however, see that Professor Burstall had an engine carrying out the conditions of economy under high compression. In a small engine such as he had used in these experiments—with 6-inch cylinder and 12-inch stroke—the loss by leakage was very great. He had often noticed in an engine of this class that, if he only turned an indicator on for an instant to get a card, he had a considerable falling off in speed. A slight leakage through an ordinary Richards indicator was enough to interfere with an engine of this type. A timing-valve of the kind used was very severe upon small engines. When an engine of this sort was rotated at, say, 180 revolutions (which was a speed one never used in practice), they would have quite an appreciable proportion of the whole of the contents of the cylinder discharged through the timing-valve previous to ignition; so that they would always lose economy in that way. As the result of several of the points that he could see about the engine, they could very easily have an error introduced not far short of 10 per cent. Regarding the igniting-valve in this engine, they would have to discharge, at the moment of opening the valve, a considerable part of the contents of the cylinder, in order to clear out the whole space before the mixture could reach the igniting-tube. In that case, using an engine giving 118 revolutions at 52 lbs. pressure, and, on the other hand, a pressure of 86 lbs. and 177 revolutions, they would lose a larger proportion at the high pressure than at the low one. In the case of this engine, he could hardly conceive it possible that the proportion of loss would be the same. All gas engineers were aware that economy depended very largely upon the nature of the mixture used. In a paper which he read before the Institution of Civil Engineers in 1886, he gave a set of experiments which he had made on gaseous explosions. He found that the best mixture to produce the maximum conditions of pressure and duration of pressure was 1 of gas in 11 of mixture—that was, 1 of gas to about 10 of air by volume; and engineers constructing and designing engines always used a mixture not far removed from that (either 1 to 10, or 1 to 9). It was very well known that if they used, for instance, anything like 8 to 6, that they at once got a condition where economy became impossible. Gas engineers had long been accustomed to use mixtures of about 1 in 11; and they were perfectly well aware that, if they departed largely from that proportion, they obtained results which were not economical. So much for the inaccuracy of coming to conclusions without properly selecting the conditions. He feared the seventeen experiments in the paper did not prove very much. The conditions were far too mixed. The conditions were not varied one at a time, nor were there a sufficient number of experiments under each condition to make sure of the results. There was another point that had to be watched very carefully in these experiments, and that was the effect of the change of speed. Theoretically, assuming that an engine gave a uniform diagram at a low speed, at a high speed there should be greater economy—with proper proportions of valve areas and so forth, the economy was greater at a high speed than at a low one. But if the proportions were improper, they would get an entire change in the nature of the mixture in the cylinder, and an entire change in the point of maximum pressure; and at such a point they would be working, with the engine at high speed, at a greater loss than if it were being worked at a low speed. The points of his argument were: First, that the engine used in these experiments was not, so far as he could see, a proper one for the purpose of the experiments. Second, as to the arrangement of the igniter, it was not, in his opinion, a proper thing to use in experiments of this class an igniter discharging part of the contents by a bye-pass or separate valve. Professor Burstall would do better with a new tube igniter properly adjusted. Thirdly, a whole series of experiments should be made with one mixture, and with the best mixture, at one compression, then at another compression, and another, and so on—all carried out with a properly arranged engine, made for the purpose of standing high compressions, or they might show that compression, instead of being good, was an evil. He felt it was important that the Committee of the Institution should understand these conditions which were not really evident excepting to those who were daily engaged in work of this character.

Mr. James Atkinson, having thanked Professor Burstall for his very careful experiments, said that many of the arrangements were extremely interesting, notwithstanding Mr. Dugald Clerk's criticisms. He (Mr. Atkinson) had been testing gas-engines for a good many years now; and, in testing a small engine, he should not dream of taking an indicator test. They could never get a good indicator test with a small engine—the losses were so serious; and a satisfactory result could not be obtained. With regard to the Wayne indicator, Professor Burstall mentioned that the rotating piston did not touch the containing cylinder at the outer extremities of the piston. This meant, of course, that there must be considerable leakage past these points, and that leakage would vary very much with the speed at which the engine was running. A little leakage passing an indicator when applied to a steam-engine was not a serious matter; but in the case of a gas-engine, they were leaking away the mixture before igniting it—all the time during compression, and probably some time after ignition had taken place. Therefore, leakage passing the indicator of a gas-engine was more serious than when passing the indicator of a steam-engine. It was some little gratification to him to hear that Professor Burstall found the Crossley method of ignition was the most satisfactory one. He could not agree with the remark in the report as to the ignition by porcelain tubes not being as prompt as with iron ones. Messrs. Crossley Bros. had made these porcelain tube igniters; and he had thought it desirable to take a diagram from an engine using one. [A photographic enlargement of this was exhibited in the hall.] The ignitions in this case were very prompt. The enlargement of the diagram revealed a very interesting thing. It was noticed that the line was not a clear one; it contained a series of jumps. The original diagram was taken by a lead pencil; and the jumps showed that the friction of the lead pencil did not in any way cause any error in the diagram, because when the pencil jumped over the spaces, it took the tension that was due to the spring. It was therefore quite as satisfactory an arrangement as the smoked mica referred to in the report. There was one little matter that Professor Burstall had not included in his paper. He had given an analysis of the gas, and the heating value per pound; but he had not given the number of cubic feet per pound. Of course, it could be worked out from the analysis; but it would be a useful thing if he could state what it was. He (Mr. Atkinson) was pleased to note that in the next report, Professor Burstall would give some heat tables, which were very useful and interesting. Replying to a question, he added that the indicator with which the diagram to which he had referred was taken was a modified Richards indicator, specially constructed in one or two points.

Mr. Druitt Halpin remarked that, so far as he could see, the Wayne indicator was similar to one made by a Mr. Longridge some fifteen or twenty years ago. The only difference he noticed in it was that, small as was the inertia in the spring of the Wayne indicator, the inertia in Mr. Longridge's spring was still smaller.

Professor W. Robinson (Nottingham) said the Institution were to be congratulated on undertaking a series of experiments of this character, and the Committee especially for aiming at the accuracy of the results indicated by the experiments. He thought they could not thank Professor Burstall too heartily for the extreme care he had taken in the calibration of the measuring instruments by reference to standards. This was a point that was often neglected. He noticed that Professor Burstall had not stated whether he used the readings of the barometer; but he supposed he had done so, because the variation in the pressure of the barometer might very seriously affect the quantity of the gas that was likely to enter. The air being dry or moist at the time of the experiments might also have an appreciable effect, though not very much. Then, again, no mention was made in the report of the brake horse power, nor of the duration of each individual test—that was, the length of time, or the number of observations taken, for a given test. It would be very interesting to know this. He supposed the heating values were found by Junker's calorimeter. He observed that Professor Burstall started his report with the rather singular assumption that the want of information on the subject of gas-engine tests was due to the fact that gas-engines had not hitherto been made for experimental purposes. It would be interesting to hear some of the makers of gas-engines speak on this point. It was just possible that some of them might think that they had, to their own cost, made too many experimental engines, and perhaps not enough of the ordinary working type. Of course, the fact that the results had not been published they must regret, as a record of the failures or stumbling-blocks that other people had met with would save a good deal of trouble in the future. He had been looking at tests Nos. 4 and 16 in the tables; and there they had some remarkable results. It was pretty well known, among gas engineers at any rate, that, when an engine was designed especially for changing speed, they might increase the speed and have increased efficiency up to a certain point. As to increasing the compression, and consequently the efficiency, he quite agreed with all that Mr. Dugald Clerk had said as to the inadaptability of the engine for this purpose. In the tests Nos. 4 and 16, it

would be noticed that the mixtures—the respective volumes of air and gas—were nearly equal: 7·13 and 7·18. The speed in the two cases was also very close; and yet the efficiency came out in the case of the low compression to 27·3 cubic feet of gas per indicated horse power per hour, and in the case of the high compression to 30·28 cubic feet per indicated horse power per hour. So that it was not necessary to go back to the old engines to see when this would occur—here they had high compression giving lower economy! If they examined this a little more closely, it would be found that the quantity of gas admitted was different in the two cases. The ratio would be about 6 to 5. So that in No. 4, a larger quantity of gas for every explosion was being dealt with. This was further explained by the variations of the explosions. The actual explosions in No. 4 were 52 to 82, or something about that. In No. 16, the explosions were 70 to 78. Clearly, then, the engine was being forced in the latter case; whereas in the other, they had only 52 out of a possible 82. This seemed to indicate that, during the other 30, air was being drawn in, and the sides of the cylinder were being cooled—the engine was becoming in a better state to take in the next charge. This action had done more than anything else to increase the efficiency in ordinary work of the "Otto" type of engine. He had pointed out these various things to show that making what would appear to be one change in condition, they really altered the whole of the conditions.

The further discussion of the report was then adjourned to the next meeting.

SPRINGS AND WELLS FOR TOWN SUPPLIES.

To complete our report of the proceedings at the meeting of the British Association of Water-Works Engineers on the 12th inst., we this week give the principal parts of the paper on the above subject, read by Mr. H. W. Pearson, M.Inst.C.E., the Engineer of the Bristol Water-Works.

In the first section of the paper, the author remarked that rain is the feeder of all springs, whether surface or in the form of wells. From 30 to 40 per cent., or somewhat more than a third of the rainfall, is found to percolate through the strata, to go to springs and wells; the remainder being left to shed off and evaporate. Taking the surface of England and Wales as 58,320 square miles, and allowing one-third of the average ascertained rainfall, we get a quantity of water sinking into the bowels of the earth equal to 1,625,868,288,000 cubic feet, or 10,161,682,800,000 gallons. In the sandstones in the area west of Bristol the author allows a percolation of 45 to 50 per cent.; and in chalk 15 to 25 per cent. In the county of Hertfordshire, from the New River Company's sources, it is estimated that the natural percolation amounts to 4 inches out of 26 inches of rainfall. Regarding the cycle of climate in England over which a series of gaugings should be taken, the author considers that about 17 years will suffice.

In dealing with the question of the selection of sites for large water supplies, the author first urges the necessity of a certain amount of geological knowledge, to ensure success. The chalk formation which surrounds London—stretching southwards to Hampshire, Kent, and Sussex, and eastwards taking in a great part of Hertfordshire, and the whole of Norfolk and nearly all Suffolk, as well as part of the north-east of Lincolnshire and Yorkshire—is a fruitful source of water supply, and covers an area of 15,000 square miles. London clay superimposing the chalk renders it more dense than it would otherwise be where it is without such weight, and would consequently leave a freer passage for water through its interstices, owing to its having a line of least resistance; and a well sunk in such chalk would deliver water more freely than one in the other. Wells sunk in chalk always get a free supply of water from the upper flint beds, where the underground spring water is flowing to some natural outlet—say, a river or spring; and as sinking is continued, the water has a very slow movement through the horizontal fissures and comes up milky. But these fissures are opened by pumping, anda freer circulation and issue is thus set up. Around London and at Wokingham the wells are mostly sunk to a depth of from 300 to 400 feet; the chalk bed being about 650 feet in thickness. The wells and springs singly yield from a minimum of 5 to a maximum of 600 cube feet per minute, equal to 5 million gallons per day average. Chalk absorbs water to a large extent in saturation in its pores—viz., about one-third of its bulk. In other words, a cube foot of chalk will hold a little more than 2 gallons, and parts with it very slowly; the springs met with in sinking being mainly due to free water passing along the cracks and fissures which traverse it in all directions down to its very lowest portion.

The new red sandstone formation, both in the Keuper and Bunter series, is always looked upon as an area which can be relied upon for yielding supplies of water of abundant and good quality. It is from these sandstones (the Keuper and Bunter) that some of the largest cities in England are mainly supplied—notably Birmingham, Liverpool, Wolverhampton, Nottingham, and also South Staffordshire. Turning to the West of England, the localities in this stratification with which the author is more closely acquainted are those situated about 9 miles to the west of Bristol, near Yatton, and to the south-west in the Yeo Valley, 11 miles from Bristol. The rainfall in these districts averages from 30 to 40 inches per annum; and of this not more than 14 inches to 16 inches percolates into the sandstone. The sandstone takes up or absorbs about $\frac{1}{3}$ of its weight of water, or nearly a gallon per cube foot, especially if of an open nature. The author calculates that in the Chelvey district there is an annual percolation of 16 inches of rainfall, equal to 700,000 gallons per square mile per diem, as it is very heavily saturated, and the surface stands only 50 feet above mean sea-level, with an absence of any streams having their origin from head springs. The area contributing to the yield of water from these wells is estimated at 8½ square miles, which gives nearly 6½ million gallons per day.

The author next describes one of a series of wells sunk at Chelvey. The well (which is circular in form) is 7 feet in diameter, and 160 feet in depth. For the first 18 feet, it was sunk through the red marls—only a small quantity of water being met with. The sinking then went on at the rate of 10 feet per week down to a depth of 67 feet, when the water proving too much for the small pump in use, a 10-inch pump was fixed, driven by a 12-horse power horizontal engine. The sinking was then proceeded with to a depth of 72 feet, when it was suddenly interrupted by the tapping of a strong volume of water (300 gallons per minute) under a bed of hard stone, which severely taxed the pump. As it was clearly seen that, if the sinking proceeded with this water coming in, the pump would be overpowered, it was determined to wall the water back. This having been duly accomplished, the sinking was again proceeded with; and at a depth of 100 feet, the strata showed as being more of a sandy nature, and contained more water. It was therefore deemed advisable to have extra pumping power; and two pumps of 14 inches diameter, with 5-feet stroke, were decided upon. At first one only was fixed, in addition to the 10-inch pump already at work. An engine-house was built for this pump, in which a 20-inch cylinder horizontal engine of 4-feet stroke was erected. At a depth of 120 feet, a further yield of water was obtained in the sandstone in pebble pockets and beds; necessitating the lowering into the shaft of the second 14-inch pump in place of the 10-inch one, which had to be removed—the clack seat having burst through too fast driving. Sinking now went on at the rate of 2 feet per week, with a quantity of water to be pumped of 500 gallons per minute; the strata passed through being variegated sandstones, and grey stone in beds of from 9 to 18 inches thick. To show the large amount of water held in this area, the author mentions that a small well only 80 feet distant, with boreholes to a depth of 140 feet, was overflowing the surface of the ground at the rate of 190 to 200 gallons per minute at the same time as the sinking was going on in this well. It was then decided to sink the well to a depth of 160 feet, with the view of driving headings at a depth of 140 feet. To prove the ground, a 4-inch borehole was put down; and at a depth of 177 to 180 feet, a spring of 200 gallons per minute was tapped. The sinking to the stage of 160 feet proved to be slow, on account of the difficulty experienced in coping with the water—six months being taken to accomplish the depth of 20 feet; the buckets and pump-valves having to be constantly withdrawn for examination, for if the least worn the pumps were overpowered. The quantity of water pumped at the termination of the sinking was 1½ million gallons a day, the cost of which was 30s. a day, or at the rate of 20s. per million gallons pumped 100 feet, and so on in proportion for lesser or greater depths.

At the completion of the sinking of the well to this depth, the yield was so satisfactory that larger and more extensive wells have been sunk. One is oval in form, with a major axis of 13 ft. 6 in. and a minor of 9 feet, walled throughout, and fitted with permanent bucket and plunger pumps, 24 inches diameter and 4 ft. 8 in. stroke, worked by rotary (condensing) beam engines, with 45-inch cylinders and 5 ft. 6 in. stroke, and lifting 3 million gallons per day in two lifts. This well cost at the rate of £30 a yard to sink, owing to the large quantity of water met with (exclusive of brickwork), most of which was put in in cement at a cost of £2 a cube yard.

After a lapse of time, the author was instructed to sink an 18-inch borehole at the bottom of the 7-feet shaft. In this boring the Dolomitic Conglomerate was pierced at a depth of 282 feet, and proved to be about 30 feet in thickness, and overlying the blue dunns of the coal. At this stage, the boring was stopped. It so augmented the supply of water that a further large pump of 26 inches diameter and 6-feet stroke had to be put in. In this borehole, the author has fixed a plug to seal the water back, so as to enable the pumps to free the well to the bottom for the purpose of driving headings from the adjoining shafts.

The cost of sinking wells in the sandstone varies very much according to the size of the wells and the difficulties experienced with water and other contingencies. At Wolverhampton, a well sunk to a depth of 100 feet to 130 feet cost £5 per yard forward; and headings, £10 per yard. The author gives the following information as to the prices for the work at the Chelvey wells: 7 feet well, to a depth of 160 feet, inclusive of pumping, £1500; engine-house, 30-horse power engine, pumps, &c., £1300; wells of 14 feet diameter and 170 feet deep sunk at same place, £12 per cube yard; 9-inch brickwork in mortar, £2 a square yard on face; pumping, 20s. per million gallons pumped 100 feet; drifting at the depth of 170 feet, 6 ft. by 4 ft., £30 to £40 a lineal yard. The author mentions that the additional wells put down have permanent engines and pumps fixed over them, equal to a total pump horse power of 750, and capable of raising 9 million

gallons per day. To show the yielding capacity of these wells, the author has, in the driest periods of 1887 and 1893, pumped from these sources for supply a quantity equivalent to 6 million gallons per day.

The following is a *résumé* of the lengthy discussion which followed:—

Mr. F. J. Bancroft (Hull), referring to the percolation of rainfall, quoted figures from the report of the Royal Commission on the Metropolitan Water Supply to show that there was little trustworthy evidence on the subject, and what might be the correct quantity in one district would be fallacious when applied to another. Artificial percolation gauges were interesting; but they must not be taken as actually representing Nature. With respect to the sites for wells, he agreed that geological knowledge was important in determining the best position for a well; but, in addition, stress should be laid upon obtaining the greatest amount of information as to the line of saturation. This latter, too, unless carefully interpreted, might cause very misleading conclusions, as although it was an index to the pressure of the water, it was no criterion whatever as to the volume. Respecting the quantity of water that chalk would hold, Mr. Pearson told them that it would absorb about one-third of its bulk. Taking a square mile, 300 feet thick, this worked out to 16,727 million gallons; but he did not think it would be seriously contended that this water was available for water-works purposes. The only water to be obtained was the water of passage—that which had percolated from the surface and was passing on to some outlet, and resembled a river. The rainfall of the winter months should be noted, as, although the annual rainfall might be above the average, if the six months ending in March were dry, the springs would undoubtedly suffer the following year. At Hull, in the six months ending March, 1891, the rainfall was about 5 inches below the average; and scarcity of water was only prevented by obtaining an additional supply from a new pumping-station. Mr. Bancroft then referred to copies of a diagram which he had prepared, in fulfilment of a promise to the members, in order to show whether the wells of the Hull water-works had any influence one upon another. From the Humber to the Springhead pumping-station, it was 2 miles 247 yards; and from Springhead to the Cottingham station, 3 miles 20 yards. Two curves on the diagram indicated that there was no sympathy between these two wells; and that variations in the water-level at Springhead were mostly seasonal. At the Springhead well there were about 2 miles of adits in the chalk; while at Cottingham, the supply had been pumped from about 450 feet of adits, and work was being executed to the extent of 1400 feet. At Dunswell—about 1½ miles to the north-east of Cottingham—the Corporation had a well which was acquired from the Newington Water Company. A curve showed that in this case there was a slight drop at the end of April and in July corresponding to the lowering of the levels at Cottingham—thus indicating sympathy between the water-levels at the two positions, but not to a great extent. Mr. Bancroft thought the members would agree that the wells at Springhead and Cottingham, if not the most remarkable, were certainly among the most remarkable, wells for the yield of chalk water. The greatest yield from Springhead last year was 6,783,000 gallons in one day; and the well could be relied upon to give 7 million gallons. At Cottingham, the greatest yield was also at the rate of 7 million gallons, including the water pumped to waste in the adit extensions. As to the questions of yield and water-level, he said that utterly misleading conclusions might be arrived at in dealing with averages. There was a maximum day's demand in every year, and a maximum hour's consumption in that day, and the yield of the well had to be equal to this. Of course, if there was a service reservoir, the maximum hour was eliminated from the problem as far as the wells and machinery were concerned; but the maximum supply required in any one day must remain an important factor. To illustrate this in the case of Hull, the average consumption per day in 1897 was 8,577,000 gallons, which equalled 37½ gallons per head; but the greatest quantity sent out was 10,562,000 gallons, which equalled 46½ gallons per head, and during the maximum hour's demand on that day water was being pumped at the rate of some 17 million gallons per day. Recognizing the importance of being aware of the maximum demand, it would at once be seen how essential it was to ascertain whether the yield of the well was seasonally affected; and, if so, whether the time of maximum demand in the district corresponded with the period of the greatest or the least yield from the wells. At Hull the maximum demand was in August; and the yield of the wells, as evidenced by the height of the springs, was greatest from January to May.

Mr. H. Preston (Grantham) remarked that he had read somewhere that in the Liverpool district there was a considerable percolation of water from the sea into the new red sandstone. The wells described by the author were considerably below the level of the sea; and he should like to know whether any variation in the quality of the water had been noticed.

Mr. W. Matthews (Southampton) differed from the author as to the amount of water that was available from sandstone, and chalk particularly, after allowing for evaporation. The evidence given before the Royal Commission on the Metropolitan Water Supply two years ago showed conclusively that rather more than one-third of what went in was available, or about 40 per cent. Speaking of evaporation gauges, he said results obtained by them ought to be accepted with reservation. Being of such small cubical capacity, they were open to many objections. They were very much more affected by temperature and climatic influences than would be the same material *in situ*. He had been conducting some experiments for the purpose of ascertaining the evaporation from the free surface of water; and the results showed that it was more than might have been anticipated. Mr. Pearson suggested that a series of gaugings taken over a period of 17 years would embrace the usual cycle of wet and dry periods. He (Mr. Matthews) rather doubted whether this would be sufficiently long; he should prefer to take 30 years. He proceeded to speak of the desirability in sinking operations of putting down pumping plant, in the first instance, in excess of anything that might be expected, so as to avoid the cost and delay occasioned by having to change the plant. The author gave the cost of drifting at a depth of 170 feet, 6 ft. by 4 ft., as £30 to £40 per lineal yard. He (Mr. Matthews) should not have thought the cost in sandstone would have amounted to much more than in chalk; and he could get the work done in chalk, with a very fair amount of timbering, at £3 per yard. Regarding Mr. Bancroft's diagram, he said there was a difficulty in estimating the level of water and the seasonal variations from a pumping-station where a varying amount of pumping was going on. He would suggest that it was a better plan to select from the surrounding district a few wells just—and only just—out of the range of the effect of the actual pumping (so that one got away from the actual cone of depression formed by the pumping), and then take periodical gaugings from them.

Mr. Percy Griffith (London) said his experience differed from a statement of the author's as to wells sunk in chalk covered with clay. He had found that where chalk had overlying it a great depth of clay, and other strata perhaps, the yield of water in many cases was very small. The explanation of this had been stated to be that the superincumbent weight on the chalk practically closed the fissures, and prevented the passage of the water. He was interested in the author's description of his boring in sandstone, for the reason that he was carrying out a scheme under somewhat similar conditions at Gainsborough. There they had a depth of 700 feet of marls, of varying character. At 700 feet this was almost impermeable, and contained practically no water, and what there was was valueless. On the other hand, Mr. Pearson met with a superabundance of water. Below the 700 feet in the Gainsborough well, there was a considerable depth of sandstone pure and simple, which yielded a large supply of water, and was under considerable head due to the impermeable strata overlying it. The boring was to go down to a depth of 1450 feet, and not less than 18 inches diameter at the bottom. During the sinking of the author's well, it appeared that the permanent pump was put in, and used while the work was in progress. It was unfortunate when it was necessary to employ for sinking operations a pump that was to be used permanently, as it must suffer considerably. It would be interesting to know what the cost of the complete boring was, and also just what the item for pumping included. The latter was a small figure—about a farthing per 1000 gallons.

Mr. E. A. B. Woodward (Wolverhampton) said the bulk of the supply to the town he represented came from a well and boring in the Bunter formation. The well was 140 feet in depth, 12 feet in diameter; and with the boring, the total depth from the surface was 918 feet. They obtained a yield from this of more than 4 million gallons per day. The author stated that the cost of his well averaged £30 a yard; the reason for this excessive figure being the quantity of water that was met with. At Wolverhampton they had had work executed by a contractor, and in another instance by the Corporation. In both cases the pumping was carried out by the Corporation, and was not taken into account in the outlay on the sinking. The cost of the contract work for a well 120 feet deep by 12 feet diameter averaged £12 per yard; and in 1891, the Corporation carried out similar work (the well being 140 feet deep by 12 feet diameter) at an average cost of £17 8s. per yard. Mr. Pearson had referred to this latter well, and had put the cost at £5 a yard. This was the price of the successful tender; but he need hardly say the contractor failed within a month or two of the acceptance of the tender. The cost of the 918 feet boring amounted to close upon £4000. The author stated that the Keuper series was always looked upon as yielding water of abundant and good quality. His own experience in Staffordshire had not confirmed this. The water from a boring which he put down two years ago was of such a quality that it was thought advisable not to use it. It contained 8·12 grains of combined chlorine.

Mr. W. Watts (Sheffield) thought the statement in the paper as to the percolation of the rainfall being 30 to 40 per cent., needed some qualification, as otherwise it would be misunderstood to mean that the rate was uniform all over the country. As to the observation of one speaker as to the sea feeding springs, he did not think any reliance should be placed on that. When the Dukinfield colliery was sunk a good many years ago, saline matter came from the bottom—almost as saline as the water in the sea; and he believed the distance from the sea was something like 20 to 30 miles.

Mr. J. Johnstone (Brighton), on the question of the percolation of the rainfall, said that the amount available depended entirely on the nature of the various strata. He had one well situated about 2 miles south-east of another; and from the former they obtained a great deal more water than from the

latter—not because, so far as they could ascertain, a larger area was tapped, but because of the nature of the chalk itself. It was a much softer chalk. The headings only varied from 70 to 100 feet below the surface; and the whole of the exposed surface in these headings gave off water. In the other well, they had driven as far as 500 feet without obtaining a drop of water—in fact, so hard had been the chalk, that they had to blast it with dynamite. The water they eventually obtained must have fallen a great distance away. With regard to the 17 years' cycle of climate, he did not think, in a chalk district such as the South Downs, the mean of any number of years could be relied upon. They had to depend on the rain that had fallen not many months previously.

Mr. W. G. PEIRCE (Richmond) believed that very little of the water that found its way into the adits they were driving at Richmond passed through the chalk. It was his opinion that the water travelled through faults and fissures which were in communication with streams and rivers. As to the cycle of climate being about 17 years, he could not say that would apply to Surrey; for it was about 20 years since they had had a wet season that was of any real value to the water supply. One point which should receive consideration in choosing a site for a well was its accessibility for a coal supply. He had seen a pumping-station planted on the top of a hill, about seven miles from a railway station. As to the remarks about the London clay superimposing the chalk, at Richmond they had been about 20 years trying to find a sufficient supply for the inhabitants. They had this superincumbent clay there; and after driving about 9000 feet of tunnelling, 300 feet below the surface, and with all the fissures and fractures, they had succeeded in getting 260,000 gallons of water per day. As to the new red sandstone, they had carried a boring into it to the extent of 200 feet; but they had benefited very little by it—only by about 9000 gallons of water per day, and that was very salt. The cost of driving the adits (which were 6 ft. by 4 ft. 6 in., and 300 feet below the surface), including the pumping, was 30s. per foot.

Mr. W. WHITAKER, F.R.S., said in the author's remarks about the surface of England and Wales allowing one-third of the average rainfall to percolate, he was afraid the author was not sure whether the area he spoke of included the impermeable with the permeable rocks; and, of course, they must confine themselves to the latter. The estimate of 4 inches of percolation out of a 26-inch rainfall was an error on the side of—not of excess at all events. The figure was derived from investigations with percolation gauges, which were really not a fair representation of what really occurred in Nature. Take Kent for example. Besides the Kent Company's supply, there were a large number of private wells; and if they were added together, it would be found that the quantity of water they abstracted from the chalk, *plus* the quantity still running in the streams, represented a good deal more than 4 inches of percolation. Where chalk was covered by masses of clay, he thought that less water would be got out of it. The crucial test was at Richmond, where they had the largest length of galleries that had ever been driven from any chalk well—9000 feet—and yet they had the smallest quantity of water; while at Southampton, with only 700 feet of adits, they obtained ten times as much water. As to the saltness of water from deep wells, he did not think they need bring the sea to account for it. Where they went down into rocks at a great depth, it was often found that the water was rather salt. He thought the explanation was that it was due to the original salt of the deposits in which it occurred.

The PRESIDENT (Mr. H. Ashton Hill) said he had had experience of the percolation of sea water into a well. In this instance, they had to pump increased quantities of water owing to the population over-taxing the powers of the well. But as the well happened to be near the sea coast, they soon made up the difference in quantity from that never-failing source. This was proved to be so by the amount of chloride of sodium which was revealed on analysis. Mr. Woodward had told them that the water he discarded contained 8 12 grains of combined chlorine per gallon. That was a small quantity. The water to which he (the President) referred contained about 175 grains. (Laughter.) Mr. Pearson had been taken to task as to the prices he had mentioned; but such matters should be considered in relation to the circumstances of each case. Regarding the use of permanent pumps for sinking work, it must be remembered that pumps of large power were not found hanging about just anywhere. It then became a question whether it was not cheaper in the end to put down at once a proper foundation and pump; and if the working barrel got worn out, all they had to do was to get a new one. In sinking a well, what one had to do was to ascertain the nature of the watershed—the pervious rock, and the lie of the upper strata—then find the amount of rain falling upon the surface, and estimate approximately the quantity of water to be obtained. He had lately been proceeding in this direction with one well. He had sunk it deeper, and had driven a borehole close on to the top of the coal measures, with the object of getting all the water that was to be had. The quantity obtained was just under 2 million gallons per day; and he was satisfied he could not get another drop of water from the well. In his district, the strata were very dislocated.

Mr. WOODWARD explained that, in addition to the chlorine in the water from the well to which he referred, the total hardness was 29°, 18° of which were permanent.

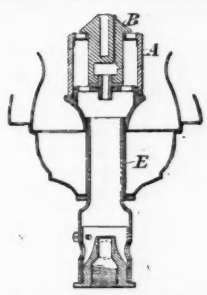
Mr. PEARSON, in the course of his reply, stated that many of the statistics which he had quoted had been taken from well-known authors. As to the remarks regarding the London clay superimposing the chalk, he intended to convey that the London clay rendered the chalk more dense, and consequently left a freer passage for the water through its interstices. With regard to the figure he had given as the cost of pumping, it referred simply to the expenditure for pumping during the sinking of the wells. It included coal, wages, oil, and so on, but not interest on capital. As to the cost of the boring, he should not like to advance the figures without having them at hand; but if he remembered rightly, the amount paid in connection with the 18-inch borehole from the bottom of the 7-foot well was about £1800. The prices given had been taken from the accounts paid for the work. Driving at a depth of 170 feet, 6 ft. by 4 ft., the cost was enhanced very much by the quantity of water that had to be dealt with. As to the cycle of years he had taken for the gaugings, 17 years appeared to him to give a fair idea of what they were likely to meet with in the Bristol area.

A hearty vote of thanks was passed to Mr. Pearson for his contribution to the proceedings.

REGISTER OF PATENTS.

Incandescent Gas-Burners.—Rose, A., of Handsworth. No. 3539; Feb. 10, 1897.

This invention in atmospheric gas-burners for incandescent gas-lights consists in the combination of an upright pipe E, through which the mixed air and gas pass to the burner, with the opened bottomed cylindrical burner A fitting on the top of the pipe, and made with a ring of



holes in the top for the passage of the mixed gas and air. The plug B secures the burner to the top of the upright gas-tube, and has a central hole to carry the stem which supports the incandescent mantle.

A further proposal of the patentee is to employ a perforated fire-clay or other non-inflammable cap fitting on or in the top of the chimney, so as to check the current of air through it; the cap being constructed and arranged so as to permit of the regulation of the size of the exit openings.

Incandescent Lighting Mantles.—Puchmüller, B., of Schoenberg, near Berlin. No. 3811; Feb. 12, 1897.

This invention relates to a fluid which, after the burning off of the fabric impregnated with it and "the directly succeeding incandescing of the firmly cohering ashes," is said to yield "a cement-like or porcelain-like compound, which serves as a basis or skeleton for an incandescent body." The fluid, which "consists of two clearly indicated oxides, has small quantities of such other oxides added to it as produce the lighting effect, and influence it as regards light, colour, and strength."

Strontium oxide and zirconium oxide are, first of all, dissolved by means of a suitable acid, or the nitrates of strontium and zirconium are dissolved in water. If a fabric be impregnated with a fluid obtained in this manner, and be calcined after being dried, the patentee says that a firmly coherent ash is produced, which forms a very good basis or skeleton for an incandescent body. It must, however, be specially pointed out that the oxides of strontium and zirconium, if employed separately, do not yield a useable skeleton, but only by the above mentioned combination and simultaneous use of the two oxides. Thus, for instance: (1) Oxide of strontium alone causes a mantle impregnated with it, when burnt off, to shrink, and then, by attracting moisture, to easily fall to pieces. (2) Oxide of zirconium alone makes a durable mantle, but even after the addition of a light-giving oxide has almost no illuminating power. The cement-like or porcelain-like compound of the two oxides simultaneously employed, only yields a little light in a bunsen flame, and also loses considerably in lighting power after burning a short time. But in order to obtain a good light of durable power, there is added to the fluid obtained by the solution of the two oxides a small quantity of light-giving dissolved metallic oxides, which (after the burning off of the saturated fibres and very energetic incandescing of the remaining ashes) yield, with the oxides of strontium and zirconium, a compound which has the property of durability. The choice of the light-giving metallic oxide to be employed depends on the colour of the light desired; and to the dissolved oxides of strontium and zirconium there is added the following metallic oxides, converted into a form easily soluble in water: Chromium oxide (as chromic acid), uranium oxide (as uranic acid), wolframium oxide (as wolframate of ammonia), molybdenic acid (as molybdate of ammonia), platinum (as platinum chloride), silver (as nitrate of silver), magnesium oxide (as magnesium nitrate), and oxide of antimony (in a solution containing tartaric acid). For yellowish white light, the following must be used: Magnesium nitrate, oxide of antimony (dissolved in water containing tartaric acid), uranium nitrate, wolframate of ammonia, vanadate of ammonia, chromic acid, and, if desired (optionally), nitrate of silver. For greenish yellow light: Magnesium nitrate, oxide of antimony, uranium nitrate, molybdate of ammonia, chromic acid, and (optionally) nitrate of silver. For a reddish yellow light: Magnesium nitrate, oxide of ammonia, uranium, nitrate,

platinum chloride, chromic acid, wolframate of ammonia, vanadate of ammonia, and (optionally) nitrate of silver.

Treatment of Calcium Carbide.—Bosca, F., of Turin. No. 4675; Feb. 20, 1897.

The object of this invention is the treatment of calcium carbide (after it is extracted from the electric furnace in which it is manufactured) in such a manner as to render its absorption of water slower and more regular, while at the same time none of its capacity for the production of, or its richness in, acetylene is said to be removed; but, on the contrary, these properties are rendered capable of more complete utilization at the moment they are required.

These objects are effected by causing the carbide, when it leaves the furnace, and after cooling, to absorb (by immersion, sprinkling, or by any other appropriate means) any fatty or oily substance which is impermeable to water—such, for example, as lubricating oils, varnish, pure or diluted tar, or the like, but preferably oils used for lubricating machinery. In these latter, it is only necessary that the carbide should be immersed for two to four minutes; its constitution, which is almost spongy, permitting it to absorb the liquid with great rapidity. The carbide thus treated is then dried in a suitable manner; and "it is ready for sale without undergoing any further treatment—possessing all its own peculiar properties, and, in addition, that of having become and of remaining completely unalterable for a very long time in contact with atmospheric influences, even under favourable conditions, also of yielding but slowly to the attack of water, when being commercially employed." By this means "its force and its richness in acetylene are maintained intact; and at the same time the simplification of the apparatus in which it is to be utilized is attainable, while rendering it far more economical."

Burners of Gas Cooking-Apparatus.—Yates, H. J., of the firm of Arden Hill and Co., of Birmingham. No. 6123; March 9, 1897.

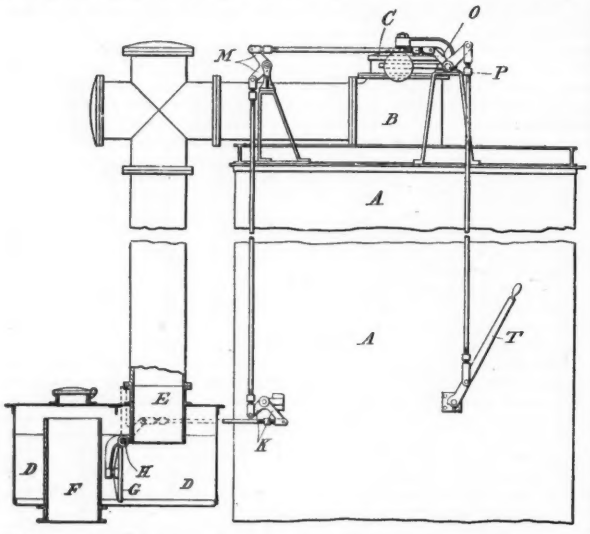
This invention has reference both to the burners and to the cocks of gas cooking apparatus—principally "grillers," in which a horizontal and longitudinal burner is disposed between a pair of grill-plates, hung or swung from their outer edges, and arranged to alternately rise above and fall below the jets of the burners, which are arranged in line, and issue from the two opposite sides, so as to play either upon the under sides of the plates for grilling, or be free to impinge directly upon the bottom of a vessel placed on the stove for boiling, heating, or frying purposes.

The burner consists of a longitudinal tube or bar, having a partition or diaphragm down its middle, so as to make two side-by-side passages, closed at one end and open at the other, with gas-jet holes provided in a line along the two outer sides of the walls of the burner, which is located between a pair of grill-plates swinging from their outer edges, and adapted, when in a grilling position, to lie above the jet-holes, so that gas-jets proceeding therefrom can play upon the under sides of the plates for grilling; but when the grill-plates are dropped, the jets impinge directly upon the under side of any vessel placed on the stove.

The means for controlling the supply of gas to the burner consist of a single cock or tap divided by a plug with a single gas-way through it; the shank of the cock also having a single gas-way, while above the plug the cock is boxed and divided off into two compartments or passages respectively in communication with the nipples taking into the openings in the burner-end.

Carburetted Water-Gas Plant.—Merrifield, L. L., of Abingdon Street, Westminster. No. 7013; March 17, 1897.

The object of this invention is to render impossible the escape of gas due to lack of water in the seal-box, either from evaporation or from some of it being driven out by excessive gas pressure—more particularly when the apparatus is lying idle, or when it is blowing up for a heat.



This is attained by connecting a valve situated at the end of the seal or dip pipe in the seal-box (between the take-off pipe of the fixing chamber or superheater, and the pipe leading to the oil-heater, condenser, and scrubber) with the stack-valve of the fixing chamber, by means of intermediate gear, in such manner that, when the stack-valve is open, the seal-valve is closed, and *vice versâ*.

In the illustration, A is the fixing chamber; and B, the stack-valve box, fitted at top with the valve C. D is the water-seal box, fitted with the seal or dip pipe E, and with the pipe F leading to the oil-heater, condenser, and scrubber. The pipe E (to the upper end of which is connected the take-off pipe X of the fixing chamber) dips with its lower end below the water-level in the seal-box D. The lower end of the pipe is faced up true; and its edge supplies a seat for the seal-valve G, which is formed by a flat disc-valve carried by an arm fixed on a spindle H, which extends through a stuffing-box provided in the side of the seal-box D, and fitted with a counterweighted lever connected to one arm of a bell-crank lever K, the other arm of which is connected to one arm of another bell-crank lever M. The other arm of the lever M is connected to a lever O, fixed on a spindle P. Fixed on this spindle is an arm that carries the stack-valve C, which is kept normally closed by the action of a counterweight. On the end of the spindle P is fixed a lever, connected with an operating lever T attached to the shell of the fixing chamber. The construction of the several parts is such that, when the stack-valve C is opened by operating the lever T, the seal-valve G is closed; but when, on the other hand, the seal-valve G is open to allow the carburetted water gas to flow down the seal or dip-pipe E into the seal-box D, and thence into the take-off pipe F, the stack-valve C is closed.

Gas-Motor with Differential Cylinders.—Smith, G. G., of Franklin, Vermont, U.S.A. No. 14,298; June 12, 1897.

The object of this invention is to construct a gas-motor in which an effective stroke is given to the piston at each revolution of the shaft—thus avoiding the "cycle system" and fly-wheel entirely. At the same time, the explosion chamber behind the piston, which occupies about a third of the capacity of the cylinder in the "Otto cycle" system, is avoided; and the products of combustion are entirely removed from the cylinder after the explosion has taken place.

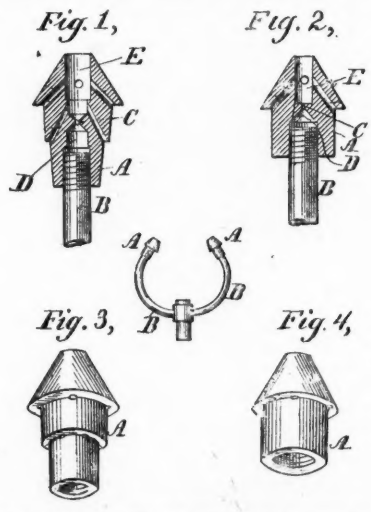
In order to render possible the omission of the explosion chamber in the working cylinder, a chamber has to be provided which is in connection with the cylinder, and which may be cut off from the cylinder after each explosion has taken place—*i.e.*, the explosion chamber would have to be partially or entirely divided off from the cylinder during the backward stroke of the piston, or while the products of combustion are being expelled; and, furthermore, the feed of the explosive gas or gas mixture would have to be cut off from the explosion chamber until the products of combustion have been removed therefrom. In order to attain these results, two conditions must, says the patentee, be fulfilled: First, the explosive mixture must be fed to the cylinder under the pressure necessary to effect the explosion; and, secondly, the feed must only take place at a certain predetermined moment—*i.e.*, at the moment before the explosion is to occur. It is, however, not advisable, nor in some cases even possible, to store a considerable quantity of explosive mixture at the necessary pressure, on account of the danger involved; and, in order to avoid this disadvantage, according to this invention, the air and gas are conducted separately to a mixing-valve arranged in proximity to the explosion chamber, and are thus mixed on entering the chamber.

After many experiments, the arrangement of a differential cylinder appeared to the patentee to offer the best means of effecting the desired results, and fulfilling the necessary conditions. In accordance with this idea, a smaller cylinder is arranged behind the working cylinder—serving as an explosion chamber. The two cylinders are separated by a slide while the explosive mixture is being fed to the explosion chamber; the slide being suddenly opened the moment before the explosion takes place, and being gradually closed immediately after the explosion.

One form of embodying the invention is diagrammatically illustrated; but otherwise it is not described.

Acetylene Burners.—Dolan, E. J., of Philadelphia, U.S.A. No. 20,010; Aug. 31, 1897. Date claimed under International Convention, Feb. 18, 1897.

The patentee points out that hitherto great difficulties have been experienced in making a burner suitable for acetylene gas—largely due to the fact that, after a certain time of burning, a deposit is formed at the point of exit of the gas from the burner, which gradually chokes the outlet and distorts the flame. The difficulty is not cured by merely



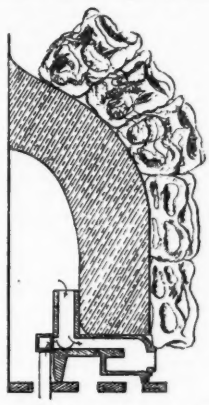
mingling air with the gas before it is burned, as it seems to be due to the fact that acetylene decomposes at about red heat—forming benzol, carbon, hydrogen, and other compounds, and if at this point of decomposition a receptive surface is present, the carbon is likely to deposit upon such surface, producing the difficulty described. If, however, a substantial separation can be made between the burner surface and the acetylene as it issues from the burner, the deposit is less likely to occur; and the deposit has also been found in practice to be less when acetylene mingled with air is burned than when pure acetylene is burned.

The burner now to be described is said to avoid the difficulties by combining two independent gas-jets at a proper angle so as to produce a flat flame. The gas-jets issue from two circular orifices, pass through a chamber where they are surrounded by the indrawn air, and finally meet in space to produce a flat flame. The tip of the burner A is, at a point at or near its longitudinal centre, provided with a contracted passage or opening C, which connects the two larger chambers or gas-passages D and E; the cylindrical passage E terminating at the extreme end of the burner-tip, thus affording an enlarged passage for the gas. There is a series of inclined air-passages leading into the enlarged passage E above the point at which the contracted opening C is provided. Ordinarily, a single row of these air-passages will be found to be sufficient, as is shown in figs. 2 and 4, though if for any reason it should be preferred, two or more may be provided, as in figs. 1 and 3.

In order to produce the best results, it is advisable to use the burner in duplex form. The flames from the burner-tips then unite at a point between, and slightly above, the plane of the burner-tips, and a flat flame is produced. The gas, being forced through the contracted openings within the burners under pressure, forms a flame circular in section; and "the uniting of these two flames produces a broad and uniform flame, having great illuminating power."

Gas-Fires, &c.—M'Caig, W., of Glasgow. No. 23,297; Oct. 11, 1897.

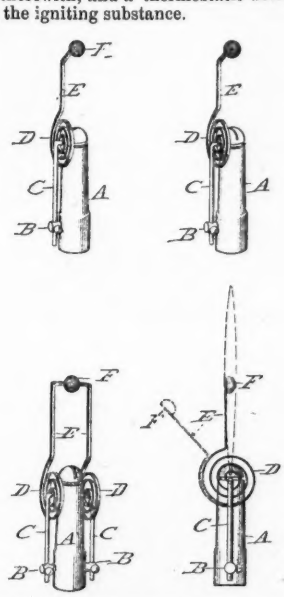
In the gas heating-stove shown in the engraving, the gas to supply the burner is conveyed into an injector chamber, the face plate of which is provided with a number of jets which open into an air-chamber centrally opposite a number of cylindric mixing chambers. These chambers in the direction of their length are horizontal; and they pass



from the back to the front of the burner. The gas passes from the injector-chamber through the air-chamber and mixing chambers to the front of the burner, where it flows down into a horizontal chamber running transversely from end to end. Immediately from this chamber the nozzles for the ignition of the gas are led. The fire-brick and ball fuel are placed relatively with the burner as shown.

Automatic Gas-Lighters.—Thompson, W. P.; a communication from T. Adams, of Brooklyn, U.S.A. No. 27,147; Nov. 19, 1897.

The object of this invention is to produce a gas-burner which will automatically ignite the gas, and then, through the heat produced by the flame, withdraw the igniting substance from the path of the flame. It comprises, in combination, a burner, a substance capable of igniting the gas by contact therewith, and a thermostatic device connected to the burner for holding the igniting substance.



Illustrations are given of two forms of burners. In both, A indicates the burner, of ordinary construction, provided with a perforated lug or projection B, extending from one side. Adjustably mounted in the lug is a rod or bar C, carrying at its upper end a coil D, composed of two strips of metal united to each other—the metals possessing different co-efficients of expansion, so that, when the coil becomes heated, it will unwind. The outer end of the coil is extended upward, and forms an arm E, to the upper end of which is secured a basket F, containing a substance capable of igniting the gas when coming in contact with it.

In the upper form illustrated, when the gas is turned on, it will come into direct contact with the basket F, and ignite. Immediately this takes place, the thermostatic action of the coil will be brought into play, and the arm E and basket F, be withdrawn from the path of the flame, as indicated by dotted lines in the lower right-hand figure.

With the parts in the relation shown, the flame will come into direct contact with the coil D, and "produce a very quick action of the parts." The degree to which the flame will be interfered with by the coil under this form, is said to be very slight—that is, the flame will be cut by the coil, but will be found to reunite as soon as it passes beyond it.

So soon as the gas is turned off, the coil will become cool; and in so doing, will draw the arm and its basket back into line with the opening in the tip of the burner, ready to again ignite the gas when turned on.

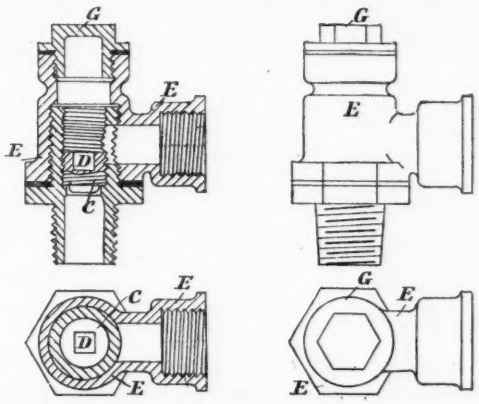
In the top right-hand figure, the opening in the tip is shown standing in a line parallel with the coil, and the coil is below the tip. The basket F, or other igniting-device, is in this instance bent slightly over, so as to be in line with the gas as it issues from the burner; but the action is substantially the same as in the former construction.

In the lower figures are shown two coils, the arms of which are connected at the top to carry the igniting-device. Under this construction, the thermostatic coils may be made of lighter material than in the forms just alluded to. The action, however, is the same.

The igniting material to be used may be "any of the known compounds or substances which possess the property of absorbing and giving off oxygen and causing combustion—such as spongy platinum, platinum black, and the like."

Making Connections with Water and Gas Mains.—Hill, J. K., of Walton-on-Thames, and Bright, P., of Newgate Street, E.C. No. 27,384; Nov. 22, 1897.

This invention relates to ferrules for making connection with water or gas mains, while the main is subjected to internal pressure, and with the aid of any suitable drilling and tapping apparatus; or while the pressure is shut off from the main, and with the aid of ordinary drilling and tapping tools only.



As shown, the ferrule is screw-threaded at its lower end, and adapted to fit liquid or gas tight into the tapped hole in the main. It is also screw-threaded at its upper end, both externally and internally, and is provided with a faced valve-seat. C is a plug, faced at its lower end to fit tight against the valve-seat. It is screw-threaded externally to fit the upper end of the ferrule, and is provided with a square recess D, for a key, by means of which it can be turned round so as to be raised or lowered. E is a cover adapted to screw on to the external thread of the upper end of the ferrule, and to make a tight joint by means of a washer with the shoulder or collar of the ferrule. G is a cap screwed to the upper end of the cover E, and adapted to make a tight joint therewith by means of a washer.

When it is required to apply the connection to a main, the plug C is screwed down in the upper part of the ferrule until it bears upon the valve-seat. The lower part of the ferrule is then screwed into the hole prepared for it in the main. If this hole has been drilled and tapped with ordinary tools while the pressure is off, the pressure can be restored as soon as the ferrule has been screwed in, because the plug C acts as a valve, and prevents any escape of water or gas. If the hole has been drilled and tapped while the pressure is on, the ferrule is screwed into the hole by the apparatus employed in the tapping, and any escape of water or gas is prevented by the plug when the apparatus is removed. The cover E is next screwed on to the upper part of the ferrule; and the service-pipe is connected to the side branch of the cover. The plug may then be screwed upwards by a key inserted from the top of the cover into the square recess D, so as to open the passage for water or gas to the service-pipe to any required extent. The cap G is then screwed on; and this closes the upper part of the cover, and prevents any escape of water or gas therefrom.

Acetylene Gas Generator.—Schülke, J. H., of Berlin. No. 27,767; Nov. 25, 1897.

This acetylene producer is so arranged that its various parts can only operate in successive order; the generation of acetylene being restricted, and the intensity of the development of the gas being capable of regulation, by varying the depth of immersion of the various receptacles, as shown in the engraving, p. 408. Fig. 1 is a longitudinal section and part elevation of the apparatus. Fig. 2 shows a plan of the generator. In fig. 3 constructive details are given.

The generator consists of a water-receptacle B, resting upon supports

A. In B, a number of generating vessels are inserted, each communicating with a gas-pipe D, connected with a pipe E leading to a pressure-feeder. This latter consists of a vessel F filled with water, and a moveable bell G suitably weighted. In F is a pipe in the form of a condensing coil, and communicating with the pipe E. It is adapted to separate the steam which is carried along with the acetylene gas; while the end of the condensing coil terminates in the upper part of the bell G above the surface of the water. At about the same level, there terminates a gas outlet-pipe I, which leads to a pressure-regulator K, with which the pipe L leading to the burners and the like communicates.

Fig. 1.

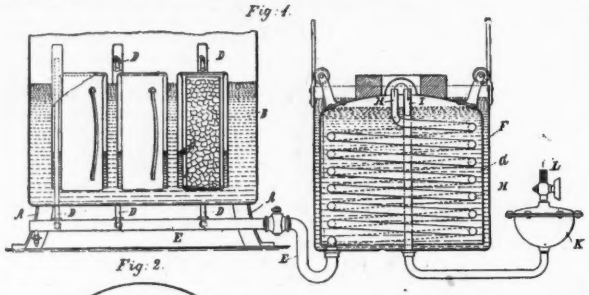


Fig. 2.

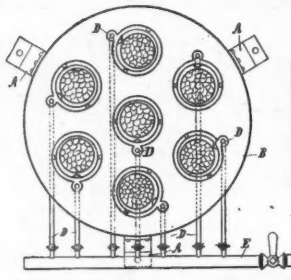
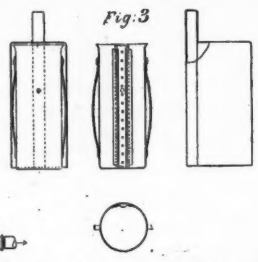


Fig. 3



The carbide receptacles consist of cylindrical casings of sheet-metal, perforated and open at both ends. Each casing is inserted into a cylinder (closed at the bottom and open at the top), surrounded by a bell open at the bottom and closed at the top. The water in the vessel B passes from below into this bell; but since the bell is in communication with the interior of the carbide receptacle, the water can only rise as high as the pressure of gas in the bell allows. The bell is provided with a gas-outlet, with which the pipe D communicates; while the cylinder is provided at a suitable height with an inlet opening. This same cylinder is preferably removably connected with the bell by springs, so that both may be removed together. A pipe communicating with the opening is attached at the inner wall of the cylinder and provided with a vertical series of holes, so that water is prevented from passing directly to the carbide, but is supplied from below. By this arrangement, decomposition of the carbide from below to the top, and the drying of the drawn-off gas by the upper pieces of carbide, is secured. The inlet-openings for the water are preferably arranged stepwise—at different levels—so that the various carbide vessels are operated in successive order.

APPLICATIONS FOR LETTERS PATENT.

3016.—Fletcher, T., Neil, A., and Fletcher, Russell, and Co., Ltd., "Gas and oil condensing stoves." Feb. 7.
3086.—Borchardt, H., "Automatic gas-lighting devices." Feb. 7.
3098.—Allsop, R. O., "Gas and petroleum engines and motors." Feb. 7.
3128.—Naylor, J. S., and Holmes, I., "Gas-burners." Feb. 8.
3147.—Major, J., "Acetylene lamps." Feb. 8.
3185.—Mathieu, C., "Feeding gas-engines with carburetted air, and producing an illuminating and heating gas by recarburetting the burned products." Feb. 8.
3190.—Morrison, A. J., "Generating and burning acetylene gas." Feb. 8.
3221.—Johnson, A. T. M., "Gas lamps or burners." Feb. 9.
3228.—Sanderson, A. W., "Acetylene lamps for lighting and heating." Feb. 9.
3244.—Rowbotham, W., "Generating acetylene gas." Feb. 9.
3279.—Joplin, W., "Gas-heated crucible furnaces." A communication from G. C. Joplin. Feb. 9.
3292.—Sarginson, W. W., "Acetylene gas generator." Feb. 9.
3294.—Ross, R. P., "Acetylene gas generators." Feb. 9.
3310.—Parkes, S. A., Everett, E. I., and Wagner, O. H., "Liquid meters." Feb. 9.
3326.—Stearn, C. H., "Clearing the burners of incandescent gas-lamps." Feb. 10.
3350.—Henwood, T., "Controlling the gas supply to incandescent gas-burners." Feb. 10.
3355.—Crossley, W. J., and Atkinson, J., "Internal combustion motors." Feb. 10.
3367.—D'Arbel, D., "Production of acetylene light by electrolysis." Feb. 10.
3415.—Spooner, A. F., "Internal combustion engines." A communication from A. Daly. Feb. 10.
3452.—Eaton, S., T., & S., jun., "Acetylene lamps." Feb. 11.
3487.—Rogers, F. M., "Acetylene lamps." A communication from Sir C. S. Forbes, Bart. Feb. 11.
3493.—M'Kean, W., "A burner for burning off incandescence mantles." Feb. 11.
3531.—Mitchell, T., "Producing and storing acetylene gas." Feb. 12.
3554.—Herriot, H. E., "Incandescent mantle and chimney bearer." Feb. 12.
3571.—Tanner, H. T., "Governor or regulator for gases." Feb. 12.
3579.—Glover, R. T. & J. G., "Coin-freed gas-meters." Feb. 12.
3594.—Rous, T., "Acetylene gas generators." Feb. 12.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Use of Breeze as Boiler Fuel.

Sir,—Referring to the question of possible injury to boiler plates from the employment of coke breeze as fuel, raised by "C.E." in your issue of the 18th ult., I can inform him that the larger proportion of all the gas-works in the South of England burn breeze in their boilers by the aid of forced draught; and though some hundreds of instances have come under my notice during a period of about eight years, I have never seen or heard of injury to the boiler plates due to any special effect of the breeze fuel. I have been the means of introducing the use of breeze as fuel in numerous cases other than gas-works, and with water-tube as well as Lancashire and under-fired boilers; and no sign of injurious action from the breeze has appeared.

W. Boby.

Feb. 16, 1898.

Standards of Light, and Gas Testing in London.

Sir,—If the writer of the "Communicated Article" in your issue of the 1st inst., entitled "Some Remarks on Standards of Light," by "Veritas," had, instead of using a *nom de plume*, affixed his signature to the article, it would have saved him the trouble of informing us that he "had considerable experience." It appears that "Veritas," during this considerable experience, has come into contact "with some people in this mundane sphere who regard photometry as an exact science;" but, since "Veritas" has not located the particular part of the "sphere" in which these strangely abnormal beings exist, he gives us no opportunity of verifying the statement. We are, however, consoled somewhat by what he calls the "colloquial phrase, I beg to differ."

I would here at once confess that the little experience I have had does not agree with that of "Veritas." All the practical exponents of photometry I have known, have bitterly lamented its want of "exactness as a science." Photometry as a theory is one thing; its practical application is quite another. In ordinary circumstances, operators hardly ever agree. On one special occasion, two distinguished men were engaged, one by an important Gas Company, and the other by the Corporation, to make experiments for the purpose of deciding a point. They used the same apparatus and the same candles alternately. At the end of the experiments, the one for the Company reported the gas 20·7 candles; and the one for the Corporation, 18·2 candles. Had the latter been testing for penalties, the Gas Company would have incurred a heavy one.

This result could have arisen from various causes not at all difficult to understand by those who, like "Veritas," have had considerable experience, and peeped behind the scenes. I could give very many instances in which the same curious anomalies have occurred. Perhaps it is sometimes caused by the gas examiner "being expected to take a side" (see "Journal" of July 7, 1896, p. 12). Other reasons could also be mentioned. The fact is that photometry, as at present carried out at the testing-stations, is worse than useless. It serves only to delude the unthinking public, and furnishes no protection whatever. It would be no disadvantage if all the stations in London were at once closed, and the Gas Referees given another thirty years in which to exercise their inventive quality in formulating a new and better scheme. I would here point out that the substitution of the portable or travelling photometer would only intensify the evil, though, according to the testimony of the accomplished Gas Examiner for Liverpool, the results obtained by it agree with those found at the fixed stations. This seems to discount somewhat Mr. W. J. Dibdin's performances in London, as reported to the London County Council. But Mr. C. R. Bellamy is not Mr. W. J. Dibdin; and doctors do occasionally disagree.

I do not here raise the question as to the reliability of the sperm candle as a standard of light, and only remark that in careful and capable hands, with a Sugg Evans photometer, it will give a truer result than the Dibdin lamp. The argand burner must, of course, be the burner till it is changed by Act of Parliament. The Dibdin ten-candle standard does not approach to a solution of the question; in its present condition it would be manifestly unjust. This has been abundantly proved by the report of the Institution of Gas Engineers; and, although the Standards of Light Commission gave a kind of feeble sanction to its adoption *mutatis mutandis*, they were not by any means clearly satisfied that it would give satisfaction. It really points to an attempt to gain a candle at the expense of the Companies. This would only result in a rise in the price of gas to the unfortunate consumers, without any advantage to them. All the Standards of Light Commissions and Committees ought not to be needed; it is the business of the Gas Referees to prescribe a substitute for the candles, and recommend it to the Board of Trade for adoption, without the assistance of Mr. W. J. Dibdin or the Gas Companies. A Parliamentary Committee could then hear evidence, and the matter be legally settled. It would be better if the whole system of gas testing were overhauled; for it is quite clear that the Gas Referees are not awake to their duties, and equally clear that no one is satisfied with the existing arrangements.

I stated in a recent letter to the "Journal," that the Referees had done practically nothing since the retirement of Mr. F. J. Evans. Here I, quite inadvertently, made a mistake; I should have exempted Mr. R. Hogarth Patterson from the charge. He, to a very great extent, perfected the present system of sulphur purification. It was successfully adopted by the Gas Companies; and Mr. Patterson brought an action against The Gaslight and Coke Company for infringing his patent. The action was tried, and a verdict given in Mr. Patterson's favour. The Company appealed; and the High Court reversed the decision. Presumably because of this action, Mr. Patterson was dismissed from his post as a Referee. Major Peirce, another Referee, was dismissed at the same time; and Mr. Foster, the Secretary, suffered a similar fate. Mr. Thompson, the Chemist, resigned. The two Referees were succeeded by Professors Vernon Harcourt and Tyndall. Ignoring Professor Harcourt, what Professor Tyndall did is known to us all. All these facts, and many others, are duly chronicled in the "Journal" of that time, and form some very instructive literature.

I would add, that the last time I saw Mr. Patterson he was appealing

in forma pauperis, to the House of Lords. The decision went against him; and he died soon after, broken in estate, body, and mind.

Feb. 12, 1898. J. VINCENT TAYLOR.

Lighthouse Illuminants.

SIR,—In a "Note" respecting the new Lundy lights in your issue of the 8th inst., we notice that you speak favourably of oil as the illuminant, and say that the oil-burner employed is novel in principle, being capable of being increased in power to meet the requirements of the weather. We think you must have forgotten the immense superiority of gas over oil as a lighthouse illuminant, proved to demonstration by the researches made into the subject, and more than once referred to in your columns.

With respect to the principle of the burner, it will be found, by reference to the Parliamentary Papers which have been published on the subject of lighthouse illuminants, that in the year 1863 the Commissioners of Irish Lights determined to make experiments with gas as a lighthouse illuminant, and placed the matter in the hands of Mr. John R. Wigham, the Chairman of this Company, whose investigations into the subject of artificial illumination had been brought under their notice. These experiments so completely demonstrated the usefulness of gas as a light-house illuminant, that in the following year Mr. Wigham was requested to devise special apparatus suitable for the purpose, and to put it into action at the lighthouse of Howth Baily—the powerful fixed light on the north side of Dublin Bay. He did so; and his system has been used in the lighthouse from that time to the present, without accident or intermission of any kind. The main features of the gas-burner are that it requires no chimney-glass, and therefore the light is not obstructed in its passage to the lenticular apparatus by which it is distributed to the horizon; and that it can be increased in power from an ordinary clear weather light of 28 jets, by five successive steps to the great fog power of 148 jets, according as the thickness of the weather renders it necessary. Professor Tyndall was sent by the Board of Trade to examine into the merits of this gas-light; and he reported that "in point of handiness, distinctiveness, and power of variability to meet the changes of the weather, it will maintain its superiority over all oils." The light was then applied at Wicklow Head, and at Mine Head intermittent lights; and also at Hood Tower (a fixed light), and at Rockahill and St. John's point (flashing or revolving light). For intermittent or occulting lights, gas possesses the great advantage over all other lighthouse illuminants, that during the intervals of darkness the light is automatically turned low and the illuminant saved.

From the Parliamentary Papers, we learn that Professor Tyndall was next called upon to report upon a new light designed by Mr. Wigham which he called "Group Flashing," respecting which Professor Tyndall says: "We now come to the next great step taken by Mr. Wigham. A beam of a certain duration is chosen; but instead of being allowed to pass steadily over the sailor, it is converted into a series of pulses or blows against the sailor's retina. By the simplest automatic mechanism, the flame, say, from a burner of 108 jets, can be suddenly extinguished, and as suddenly relighted, three, four, five, or six times during the passage of the beam. The thrills thus produced, whether upon the haze of the air or the eye of the mariner, are astonishingly effective. It is the first of the kind ever invented. 'It appears to be alive,' said its inventor, on first describing it to me, 'and actively exerting itself to warn the mariner of his danger.'" This is done by turning on and off the gas; and no such thing is possible with oil as the illuminant. This light was applied at Galley Head, on the coast of Cork, where the system of the superposition of lenses—a plan also devised by Mr. Wigham—was adopted in connection with the great group flashes.

With regard to the system of superposing lenses, Professor Tyndall says: "The next step taken by Mr. Wigham was his boldest and most important one. He was daring enough to abolish the top and bottom prisms of the splendid apparatus invented by Fresnel, and to superpose, in tiers, one above another, the central belts, each of which transmitted about 80 per cent. of the light of its special burner. He thus built his apparatus into a tower, biform, triform, or quadriform, according to the number of lenses superposed. At the focus of each tier, he places his powerful burner; thus doubling, trebling, or quadrupling his effective light. At a moderate distance from the lighthouse, the separate flames coalesce to a single luminous ball of extraordinary intensity. The beams from this ball sweep the sea in succession; and, as they pass the mariner, they are broken into the potent flashes I have described."

Here, again, oil fails. The utmost extent to which the advocates of oil can go in following the system of superposition of lenses, is to be found in the new Eddystone lighthouse, where the apparatus is biform.

JOHN J. FARQUHARSON, Secretary,
Edmundsons Engineering Company, Limited.

Dublin, Feb. 10, 1898.

Gas-Works Extensions at Haworth.—Last Tuesday, Colonel Marsh, of the Local Government Board, held an inquiry into an application by the Haworth District Council for a Provisional Order, to empower them to hold and use for gas-works purposes a recently purchased piece of land, and to borrow £2500 for carrying out extensions estimated to cost about £2213. It is intended to erect a new two-lift holder and two new condensers, and to extend the mains at Haworth and Oxenhope. There was no opposition to the application.

Colney Hatch Gas Company.—At the half-yearly general meeting of this Company to be held next Thursday, the Directors will report a satisfactory increase of 11¼ per cent. in the sale of gas in the six months ending Dec. 31. The quantity sold was 32,215,400 cubic feet, which produced £6174; and the total revenue was £7576. The expenditure being £5186, there was a balance of £2390 to go to the profit and loss account. The amount available for distribution is £3836; and the Directors will recommend dividends at the rates of 10, 7, and 5 per cent. per annum on the original, additional, and preference capital respectively—leaving £2132 to be carried forward. To meet the continued and growing demand for gas, it will become necessary in the near future to enlarge the producing and storage plant; and it is proposed during the ensuing summer to make further additions to the mains, which were extended by 470 yards during the half year. For this purpose additional capital will be required.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week:—

Bills presented and read the first time: Aberystwith Gas Bill, Bacup Corporation Water Bill, Bakewell Gas Bill, Blackpool Improvement Bill, Bury Corporation Bill, Carlisle Corporation Water Bill, Edinburgh and District Water Bill, Edinburgh and Leith Corporations Gas Bill, Felixstowe and Walton Water Bill, Filey Water and Gas Bill, Folkestone Gas Bill, Folkestone Corporation Water (Transfer) Bill, Folkestone Water Bill, Forres Water Bill, Halifax Corporation Bill, Hamilton Water Bill, Heywood Corporation Water Bill, Kettering Water Bill, Liskeard Corporation (Water) Bill, Market Harborough Gas Bill, Morley Corporation (Gas) Bill, Morley Gas Bill, Newcastle and Gateshead Water Bill, Newhaven and Seaford Water Bill, Newhaven and Seaford Water Board Bill, Newtown Water Bill, Redhill and Reigate Gas Bill, Rochdale Corporation Water Bill, Sheringham Gas and Water Bill, Stirling Gas Bill, Swansea Gas Bill, Todmorden Corporation Water Bill, Todmorden Corporation (Water Transfer) Bill, Tynemouth Corporation Water Bill, Waterford City Gas Bill, Wath-upon-Dearne Urban District Council Bill, Yeovil Corporation Bill, Yeovil Gas Bill.

The Standing Orders have not been complied with in the cases of the Filey Water and Gas Bill and the Newhaven and Seaford Water Board Bill.

The Clippens Oil Company, Limited, have petitioned against the Edinburgh and District Water Bill.

HOUSE OF COMMONS.

The following progress was made with Bills last week:—

Bills presented and read the first time: Brompton, &c., Water Bill, Carmarthen Improvement Bill, Clacton-on-Sea Gas and Water Bill, Coventry Corporation Gas Bill, Cranbrook District Water Bill, Crawley and District Water Bill, Cromer Gas Bill, Drogheda Gas Bill, East Ham Improvement Bill, Enfield Gas Bill, Frodingham Gas Bill, Gaslight and Coke Company Bill, Gloucester Gas Bill, Hartlepool Gas and Water Bill, Haslemere District Water and Gas Bill, Higham and Hundred of Hoo Water Bill, Ilford Improvement Bill, Ilkeston Corporation Bill, Keighley Corporation Bill, Leyton Urban District Council Bill, Maldon Water Bill, Matlock Urban District Council Bill, Middlesbrough Corporation Gas Bill, Mid-Kent Water Bill, Northam Urban District Water Bill, North Warwickshire Water Bill, Norwich City Water Bill, Paignton Improvement Bill, Plymouth and Stonehouse Gas Bill, Rhymney and Aber Valleys Gas and Water Bill, St. Anne's-on-the-Sea Gas Bill, St. Helens Corporation Bill, Southampton Gas Bill, Southend-on-Sea Gas Bill, Southend Water Bill, Southwark and Vauxhall Water Bill, Staines Reservoirs Joint Committee Bill, Thanet Gas Bill, Tottenham and Edmonton Gas Bill, Wey Valley Water Bill, Whitwick and Coalville Gas Bill, Wishaw Water Bill, Wymondham Water Bill, York United Gas Bill.

Mr. Pickersgill has given notice that when the Gaslight and Coke Company Bill comes up for second reading, he will move its rejection. Mr. F. Wilson will take a similar course with regard to the Wymondham Water Bill.

The Standing Orders have not been complied with in the case of the Wigan Corporation Bill.

The Conservators of the River Thames have petitioned against the Southwark and Vauxhall Water Bill, and the Essex County Council against the Ilford Improvement Bill.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Tuesday, Feb. 15.

(*Before Mr. Justice* NORTH.)

Jordeson v. Sutton, Southcoates, and Drypool Gas Company and Others.

The hearing of this case, which commenced on the 1st inst. and occupied the Court ten days (see *ante*, pp. 284, 348), was resumed this morning.

Mr. UPJOHN, Q.C., and Mr. DIGHTON POLLOCK appeared for the plaintiff; Mr. HALDANE, Q.C., Mr. MACNAGHTEN, Q.C., and Mr. BOOME, for the Gas Company; Mr. RAWLINS, Q.C., and Mr. HECKSCHER representing the Contractors (Messrs. Holme and King).

Mr. UPJOHN continued his summing up of the whole case, and pursued his citation of the case of *Shelford and Meux's Brewery Company v. The City of London Electric Lighting Company*, which was one of nuisance caused by noise at the defendants' supply station. The first plaintiff was the tenant, and the other plaintiffs were the proprietors, of a public-house at Bankside, close to the station. There had been no pecuniary loss to any of the plaintiffs; and the question was solely whether or not there should be an injunction. Mr. Justice Kekewich held that there was a nuisance; but he gave damages, and did not grant an injunction. The defendants contended that, under the Electric Lighting Act and Provisional Orders, they were entitled to commit a nuisance, though they had not this power by their Special Act as had railway companies. The Court of Appeal reversed the decision of Mr. Justice Kekewich, and granted an injunction; and in the judgments of Lord Halsbury and Lords Justices Lindley and A. L. Smith, it was laid down that the Company could carry out their works in such a manner as to diminish the nuisance by increasing the number of their stations. The learned Counsel contended that in the present case the defendants could produce the additional quantity of gas required for the growing district of Hull by

augmenting the number of their small gasholders, instead of having an enormous holder which necessitated an excavation 36 feet deep. They were really proposing to carry on their business with the same number of gasholders that they had in 1873—two.

Justice NORTH said he was not satisfied that the Company were not carrying on their business in the best way for effecting the purposes for which they were established—putting all their gasholders on the original piece of land, in lieu of erecting a large number of small ones on other sites.

Mr. UPJOHN then dealt with the subject of negligence in the execution of the defendants' works, and said that negligence, whatever the Company's statutory powers might be, would take them out of those powers. He proposed to go through the evidence to show that there had been negligence; but as his Lordship intimated that there was no necessity for this reference, he left that subject, and pursued another, suggested by a case which had been referred to—*Popplewell v. Hopkinson*—viz., that the plaintiff had a legal right to the support of his land. It had been put by the defendants' Counsel that the plaintiff had no right to such support; and he cited this case to show that the circumstances which existed at the time of his purchase disentitled him to it. In Popplewell's case, which was one of vendor and purchaser, the circumstances at the time of the sale justified the inference that the purchaser knew that there would, or probably would, be building on the adjoining land which would interfere with the support of a wall. Leaving this point, Counsel argued his question of right. He claimed a right to light by prescription, and also a right to support for his land and consequently for his houses. The right to the support of his land was a natural one; and then came the right to the support of his houses.

Justice NORTH said this would be a question of damages. There was not in the present case a prescriptive right of support for the houses. What was there to show that the damage to the land would not have been exactly the same if there had been no houses? There had been no evidence that the surface of the land, unencumbered by building, would not have been let down as much as it was by buildings.

Mr. UPJOHN then confined his observations to the deprivation of the plaintiff's light by the defendants' proposed large gasholder. Having gone through the evidence on this point, he claimed that an injunction should be granted. He afterwards argued that damages ought to be awarded for the letting down of the plaintiff's land and the injury to his houses; the weight of evidence being that the abstraction of water and running silt had caused the subsidence. If Mr. Hertzig's method of shoring had been adopted, it would no doubt have been more expensive, but it would have prevented the abstraction.

Justice NORTH remarked that there was also evidence that Mr. Hertzig's method would have been more risky.

Mr. UPJOHN said he based his argument of negligence on the non-adoption of Mr. Hertzig's system. He attributed this non-adoption to the expense of the method, and not to its risk. Were the defendants entitled to do the damage they had done, on the ground of the greater expense of another method than that which they had employed?

Justice NORTH, in giving judgment, said there were certain points on which he proposed to reserve his decision; but there were other matters of fact, which had been gone into at great length, which he thought had better be decided now. The first was as to what the effect of the gasholder in question would be on the light to the plaintiff's cottages if it were erected to the height proposed. He had not the least doubt that there would be serious interference with the light. It would affect some of the houses more than others—the scullery of the nearest house, and the staircase of another. Of course, this was not so important with regard to light, as the windows of the main rooms; but that a gasholder 105 feet high would produce a material effect on the majority of the plaintiff's houses there was no doubt. The next question was with reference to the subsidence. If it was clear that the defendants were not justified in doing what they did, it did not matter much whether it was done negligently or not. But assuming that they had the legal rights contended for by their Counsel, then these rights must be exercised without negligence in carrying them out. The plaintiff said the work had been done negligently in the present case. The negligence was said to depend on two things—one was that a better plan should have been adopted, and that the damage was beyond all question; and the other was that, even assuming no fault could have been found with the system adopted, the way in which it was put into use was so inefficient that there was negligence. First of all as to the scheme. He did not mean to say there was any negligence on the part of the defendants in carrying it out; but the evidence was that it was as good a scheme as the other—that it was in fact, as some witnesses said, the best plan. It might well be that other persons took a different view; but, assuming there was a conflict of evidence, the defendants adopted a plan which was considered by competent persons to be as good as, or better than, any other. He did not know how it could be said that they should exercise a choice in such circumstances. The suggestion made was that there were two other schemes. Mr. Hertzig was the first witness examined for the plaintiff, and there was evidence to show that what might, for convenience in this case, be referred to as the Hertzig method, was a good one, but not one that could have been adopted in the present instance. One of the best of the defendants' witnesses—Mr. Corbet Woodall—said that there was a risk about it, and that if it had been used in this excavation the middle lengths of the runners would have sealed up the bed in question. But he said there was a risk in undertaking it, and the other was the better plan. He (Justice North) felt very incompetent to express an opinion as to the merits or demerits of the rival systems. It was said on behalf of the plaintiff that the risk would have been less. On the other hand, he had this—that, though Mr. Hertzig's plan could be usefully adopted, it could not be best adopted where there were struts. In the next place, was the plan the defendants chose properly, carefully, and skilfully carried out, or was there negligence in the way in which it was done? The conclusion he came to was that there was no evidence that it was not skilfully done. He recognized the difficulty of driving the runners down in such a way that their faces would fit accurately and closely; but as they were put in in groups of lengths, the lower part of each runner projected beyond the upper part of it where it was between two adjoining runners, so that its course was directed to a certain extent by them. If the strata had collapsed, the whole ring would have burst in. Then it was said it had been proved that the work was negligently done by the various apertures which had been discovered. It was said they were noticeable, and that the four fingers of the hand could be put in. On this subject he might say there might possibly have been some places which were not hermetically sealed; but he did not think there was negligence. On the legal question whether absence of negligence was an excuse for what had resulted from what the defendants had done, he should reserve this matter for consideration. The only other point was as to what was the substance that was abstracted by the defendants' operations. The first thing was water that came from a stratum of running silt. It was not water proper, nor was it silt proper; but it was called "running silt bed"—silt of a particular character, which ran. One witness produced a bottle of what was pure water, without sediment; another offered to show him something that he had in a paper in his pocket. Both of these witnesses said this was the substance. He (Justice North) thought running silt was between the two. There was no question that there was water; and he had no doubt that the running silt consisted substantially of water and silt—the two substances being in various proportions. If the season was wet, the substance was wet; if the season was dry, it was dry, or less wet. The conclusion he came to was that what went out of this particular stratum was neither water nor dry silt, but a mixture of water and silt—the silt being mechanically suspended in the water; and the two escaping together. If there had been no water, the silt would have remained part of the strata on which the surface of the land was supported on which the plaintiff's buildings stood. There was a subtraction not merely of water, but of what was substantially water *plus* silt. He thought this dealt with the questions of fact. The question of law he should reserve.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Wednesday, Feb. 16.

(*Before Mr. Justice* WRIGHT.)

The Distribution of the Assets of the Driffield Gaslight Company.

In this case the Court was asked to determine how a sum of about £5000 should be applied as between two classes of shareholders. The Company was formed under Deed of Settlement dated Sept. 7, 1835, with a nominal capital of £12,000, divided into 1200 shares of £10 each. Last year the undertaking was purchased by the Urban District Council for the sum of £22,500; and the Company having passed resolutions for voluntary liquidation, the Liquidator had refunded to each shareholder the amount paid on the shares, and the sum of £5—leaving a surplus of £5000 odd. Some of the shares were fully paid up and some not. The shares were really divided into four classes—viz., (1) shares fully paid up and taken at par; (2) shares fully paid up on which premiums varying from £2 to £3 10s., had been paid; (3) shares upon which only £6 10s. had been paid, taken at par; and (4) shares upon which £6 10s. and a premium of £2 had been paid. The first class consisted of 537 shares; the second, of 63; the third, of 417; and the fourth, of 183.

Mr. NORTHCOTE appeared for the Liquidator; while Mr. L. O. CLARE, Mr. DUNHAM, Mr. BRENTON and Mr. HURRELL represented the various classes of shareholders.

On behalf of the holders of fully-paid shares it was urged that the proceeds ought to be distributed in proportion to the amount paid on the shares; the holders of partly-paid shares contended that the proceeds ought to be distributed in accordance with the nominal amount of the shares; while those who had paid premiums urged that they were entitled to receive back this amount. There was also a further question as to how a sum of £378 in the hands of the Liquidator, representing income earned by the Company and not distributed, ought to be now allocated.

At the close of the arguments, his Lordship reserved judgment.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Wednesday, Feb. 16.

(*Before the* LORD CHIEF JUSTICE *and a Special Jury.*)

M'Kellow v. The Gaslight and Coke Company (Tilley, third party).

This was an action to recover damages for personal injuries sustained by the plaintiff in consequence of an explosion of gas.

Mr. KEMP, Q.C., and Mr. MORTEN appeared for the plaintiff; Mr. CARSON, Q.C., and Mr. MALLINSON represented the defendants.

Mr. KEMP said, though in this case negligence was denied by the defence, he thought it would really only be a question of damages.

Mr. CARSON having assented,

Mr. KEMP described the accident. He said the plaintiff had for some time occupied rooms in a flat at Clovelly Mansions, Grays Inn Road, which were supplied with gas by the defendant Company, who, in February, 1897, were improving the supply by laying fresh services. On the evening of the 25th of that month, when the plaintiff returned home she perceived, on opening the door, a strong smell of gas, and immediately went away to speak to a neighbour. While doing so an explosion occurred; and the next thing she knew was that she was near the entrance door of the mansions. It was subsequently ascertained that a service-pipe had been passed through the wall and left open, so that when the gas was turned on at the main the room was filled; and on the door being opened the gas passed out into the landing and took fire at a light in the passage. She was taken to the Royal Free Hospital, and from there to a sister's at Camden Town, where she had remained ever since, except for a time when she went into the country by medical advice. The claim for medical and other expenses was about £100. The principal loss sustained, however, was of a business nature—plaintiff having been in receipt of about £300 a year as partner and manageress of a shirt-making business in the City, as, being unable to attend to it, her partner (another sister) had dissolved the partnership.

Plaintiff, in her evidence, said she had carried on business in the City, with her sister, Mrs. Furness, since 1881, before which time she had managed the business for Mr. Furness, who then died. She narrated the accident as above described. When she recovered consciousness, she

was by the hall door, but did not know how she got there. She did not leave her sister's house until July, except one day in May when she went to consult a specialist. Her hands, wrists, and face were burned. For some time Dr. M'Gregor attended to dress her injuries three times a day. The lower part of her face and one of her eyes were still painful. Previous to the accident she had had no illness for sixteen years. She was now very nervous, and her sight was imperfect. She had not been able to find any occupation. The profits of the business of Furness and Co. were about £400 or £500 a year, including her salary of £100 to £150. There was no specified sum; the remainder of the profit being divided with her sister. There were only two customers, wholesale houses. Since the accident, she had not been able to attend to the business; and her sister had carried it on herself, having dissolved the partnership.

Cross-examined: The business was in Bartholomew Close, and about thirty workpeople were employed in it. There had been a little dispute between her sister and herself as to the accounts.

Dr. *D. M'Gregor*, of Camden Square, who had attended the plaintiff more or less down to the present time, and Dr. *A. E. Bridger*, a specialist in skin diseases, were called to speak to plaintiff's injuries, and were not cross-examined. An accountant was also called to show that the profits of the business during the two years 1895 and 1896 were £892.

Mr. CARSON did not call any evidence on the part of the defendants. He commenced by saying that he did not appear for the Gas Company, but for Mr. Tilley, the Contractor, who was really responsible for the damages; and an order had been made entitling him to defend the action in the name of the Company. He did not question the out-of-pocket expenses; but he contested altogether his client's liability for any loss sustained by reason of the dissolution of partnership, and he invited the Jury to give only a reasonable sum in respect of the personal injuries.

The Jury retired after his Lordship's summing up, and ultimately returned a verdict for £601 6s.; being £500 in addition to the admitted expenditure out of pocket.

Charge of Stealing Welsbach Mantles.

At the Westminster Police Court, a few days since, before Mr. Marsham, Edward Corbett, 30, gas-fitter, of Oakley Street, Lambeth, and George Edward Corner, packer, of Peabody Buildings, Old Pye Street, Westminster, were charged with being concerned in the theft of 900 mantles, the property of the Welsbach Incandescent Gas-Light Company. Corner was employed at the Company's warehouse in Palmer Street, Westminster, and for some time had been suspected of stealing mantles in a raw state before being chemically treated. He was stopped one day, and searched; but nothing was then found. The detective police, however, received information; and on Saturday, the 12th inst., Sergeant Beard stopped Corbett as he was leaving Corner's lodgings with a parcel. When asked what it contained, Corbett said it was his friend's washing. The officer found that it consisted of raw mantles, to the number of 900. In consequence of what Corbett had said, Inspector Waldock proceeded to interview Corner, and on his admission he was taken into custody. The Inspector said other property was missing, and a person working in the same department as Corner had failed since his arrest to attend to his work. Mr. Marsham remanded the prisoners.

Barnet District Gas and Water Company.—In the report which the Directors of this Company will present at the half-yearly meeting on the 25th inst. they state that the balance of the profit and loss account amounts to £18,098, out of which they will recommend the declaration of a dividend (less income-tax) for the second half of the past year at the rate of 9 per cent. per annum on the "A" and "C" stocks, of 8 per cent. per annum on the "B" stock, and of £6 6s. per cent. per annum on the "D" capital. The profit on the gas portion of the undertaking was £3694; and on the water portion, £6660. The Directors report that the business continues to progress.

The Quality of the London Water Supply in January.—Reporting to the Official Water Examiner for the Metropolis (Major-General A. de Courcy Scott, R.E.) on the quality of the London Water Supply last month, Sir W. Crookes and Professor Dewar state that the 182 samples examined by them were all clear, bright, and well filtered. Their bacteriological examinations extended over 291 samples; and the results are, as usual, recorded in a table. The unfiltered water of the New River, Thames, and Lea, contained respectively 2377, 4263, and 2866 microbes per cubic centimetre; but in the filtered water the numbers were 19, 52, and 25. The reporters remark that for the time of year the Thames and Lea are in exceptionally good condition, owing to the lack of rain; but at the same time it is satisfactory to find, from their recorded results, that the filtering plant of the various Companies is in good working order, and that with the exception of one or two abnormally high results, which after all did not include pathogenic organisms, the bacteriological quality of the water supplied to London is excellent.

Gas and Electricity at Salisbury.—The affairs of the Salisbury Electric Company, after remaining in a moribund state for some years, have been taken in hand by a London Constructing Company, who are erecting works, which include the utilization of water power by means of a turbine wheel, and laying cables in the principal streets, with the view of making a start at an early date. Meanwhile, the district has been canvassed by electrical engineers; and pamphlets, setting forth both the advantages of electricity and the disadvantages of gas, with a considerable amount of imagination in each case, have been freely circulated. Statements having been made to the effect that the new agent will be cheaper than gas, the Salisbury Gas Company have issued to their customers a circular furnishing an estimate of the cost of gas required to give a lighting value equal to that claimed for a unit of electricity, the cost of which is put at 5d. It is as follows: With flat-flame or ordinary burners, 3½d.; with "Meteor" or Wenham, &c., burners, 1¼d.; with incandescent burners, ¾d., including cost of renewals. As the Company make no restrictions whatever as to the kind of burner employed, or the hours of consumption, it is pointed out that any consumer can obtain by means of gas a light six times as cheap as that furnished by electricity.

MISCELLANEOUS NEWS.

SOUTH METROPOLITAN GAS COMPANY.

The Ordinary Half-Yearly General Meeting of the proprietors of this Company was held at the Bridge House Hotel, London Bridge, on Wednesday last, under the presidency of Mr. GEORGE LIVESEY.

The SECRETARY (Mr. Frank Bush) read the notice calling the meeting, and the minutes of the last meeting. The report of the Directors was taken as read.

The CHAIRMAN said he wished, before moving the adoption of the report, to draw their attention to a personal matter, in reference to a circular or prospectus of the Patent Gas Enrichment Syndicate, Limited. Last year he was asked if he would become a Director of this concern; and he replied on Aug. 5 last, as follows: "I am glad to hear a new Company for the manufacture of gas enrichment spirit is about to be formed; but my connection with this and another Gas Company, which may be purchasers, renders it inexpedient that I should join the Board of your proposed Company." He was then asked if he would allow this letter to be used; and it never occurred to him that it could be employed as a recommendation to people to take shares in the Syndicate, for he gave no recommendation whatever. However, a gentleman living in Loughborough sent him a copy of the prospectus of the Syndicate on Dec. 21 last, which stated that the 22nd of December was the day on which the list would be closed. He was not altogether pleased at this, but thought the mischief, whatever it might be, was done, and that there was an end of it. But on Jan. 19, he received another prospectus from a friend. There was no statement in it as regarded the list being closed; and his Solicitors requested that his name might be no longer used in connection with the matter. In reply to this communication, a letter was sent to his Solicitors assuring them that his letter should not be published any further. This letter was dated Jan. 21; and on the 26th, his friend Mr. Ewart received another prospectus, which had reached his wife that morning by post. It was then thought necessary to proceed for an injunction to prevent his name being made any further use of. It occurred in the prospectus five times in large type. The name of the South Metropolitan Company appeared twice; that of the Crystal Palace Gas Company once. He had never seen nor heard of any of the material being sold or manufactured; and he did not know that any of it had been made. They asked for a subscription of £30,000 to buy a patent, which might or might not be of use. He could not say more, because the matter was *sub judice*. He then moved the adoption of the report and accounts; remarking that the first announcement he had to make was of a negative character—that the Directors did not contemplate any increase in the price of gas. Between the years 1890 and 1893, in consequence of the increased cost of coal at the time, and the increase in the payment for labour, most gas undertakings raised their price; but in succeeding years nearly all of them got back to the figure which they charged before the increase took place. At any rate, their Company had; and they saw no reason whatever for an increase, unless something totally unforeseen should happen. For instance, if there should be an abnormal rise in the price of coal, they might be placed in a difficulty; but in regard to this he thought there was no need to anticipate an increase. Gas coals had gone up in price the last month or two; but this was because the contractors had mostly entered into contracts which took nearly their whole output; and anyone who wanted a few odd cargoes would, of course, have to pay an excessive price for them. Most gas companies, however—at any rate, it was so in their own case—had over-bought, and very wisely he thought. The coals contracted for last year by the South Metropolitan Company had been in excess of their demands. Even with their increase of 6 per cent. in the quantity of gas sold, they had a considerable amount of arrears of coal to take, which they did not want at present. The result would be that, when they were in the market, they would not require to contract for so much coal for the next year. He thought that this would tell—it ought to—on the market value, because the coalowners had, he believed, the impression that the demand was going up very rapidly; but they would find out their mistake. Further, if the coal-owners attempted to put up their price at all unreasonably, the gas companies had another resource. All over the country water-gas plants had been, and were being, erected, which not only enabled the companies to make gas without coal, but also, to a certain extent, to take coke off the market. If coal was going to be very dear—he did not think it would be—they, like other companies, could fall back on water gas. Some gas manufacturers were making as much as 40 per cent. of their total manufacture of carburetted water gas. Another reason why he did not think coal would go up was the low price of coke. Coke was a fuel which competed with coal very extensively for manufacturing purposes. With coke so low in price, it would be difficult for coalowners to put up the price of coal. He therefore did not think there was any likelihood of an increase in the price of coal; and there was no need whatever to anticipate any increase in the price of gas. He would not take up much of their time by referring to the accounts, which gave a full statement of the position of the Company. The various items were very much the same as in the corresponding period of the preceding year, except one, which had continued going down. The item of carbonizing wages, which under the influence of the Gas Workers' Union, was increased from about 2s. 7d. a ton to 3s. 6d., had now come down to less than 2s. 3d. This was due to two causes. Part of it—3d. a ton, certainly was due to the better working of the men. Their men being free from the baneful influence of Unions—of which they had had such an example lately, and the object of which seemed to be to restrict the productiveness of labour in every way—he estimated that at least 3d. a ton was saved by their better working. But this left a good 1s. a ton, which was due to improved methods of manufacture. By the adoption of machinery and to a small extent of inclined retorts, they had saved quite 1s. a ton on the cost of carbonizing in the half year. With them, 1s. a ton in the year amounted to about £47,000. The question was: What had it cost them to obtain this saving? He was over-stating the case when he said that in the last five years they had expended £100,000 in alterations and improvements, and in the adoption of machinery; and he thought they would

agree with him that an expenditure of £100,000 to bring them in a return of £47,000 a year was very satisfactory. The greater part of the expenditure appeared under the heading of repairs and maintenance. They had not charged this to capital, because it did not increase their manufacturing power; and this was the reason why the repairs and maintenance account had been higher the last four or five years than for some time previously. They were happily in this position, that they had to come before the proprietors with a record of success under certain rather adverse circumstances—the very low prices of coke, ammonia, and tar. In the first paragraph of the report, they said: "The depression following the unwarranted inflation of the price of coke three years ago still affects that trade." The price of coke in 1894 was forced up to 13s. 6d. a ton; but it fell two years later to 8s. This great drop was, to a large extent, caused by the excessive rise previously, and also by another circumstance, to which he need not refer there, but to which he had alluded in a different place on another occasion. He was able to say, in regard to the cement makers, that with proper management of the coke business, they would have paid all the London Gas Companies not less than 10s. a ton, against the 8s. and 8s. 6d. to which the price fell. The extraordinary part of the matter was, he was sure, that they would have paid the 10s. with greater satisfaction than they had been paying 8s. or 8s. 6d. This seemed rather an anomaly; but he knew that they would have done it. Had the business been properly managed, the Companies would have had the higher price that he had mentioned, instead of these great losses. Ammonia had improved. It was a singular coincidence that, with the disappearance of the large stocks which were accumulated—their Company never accumulated stocks, he was glad to say—the price advanced. While these accumulated stocks remained on hand, the price seemed to go lower and lower. At last it went down to such a point that the stocks were absorbed; and as soon as this happened, the price of ammonia began to rise. It fell from between £13 and £14 a ton about four years ago to as low as £7 last year; and the price had since gone up to £10 with the disappearance of the stocks. He had now to deal with another, and perhaps the most important product of all—coal tar. They said in their report: "Tar, for instance, with sub-products of enormous value obtainable only from it, realizes less per gallon now than it did when the sub-products consisted only of naphtha, creosote, and pitch." Some forty years ago tar was distilled simply for its naphtha, creosote, and pitch. Then the aniline colours were derived from it; and a spurt was given to its value. This was about the year 1860; and some ten years later, it was discovered that from the anthracene derived from coal tar, alizarine could be produced, which was a perfect substitute for madder, or turkey red. He might say that madder had been driven out of cultivation with anthracene at £140 a ton; and anthracene would at that moment realize only about £12 a ton. Yet, the only substitute that could be used in its place would not pay to grow, even if anthracene were at £140 a ton. Why was this? The fact was that rather more anthracene had been produced year by year than the market wanted. The trade had gone to the Germans—the colour makers. He did not blame them. They had simply shown themselves more clever than the English, in whose hands the trade originally was; and he might state that the firm of Messrs. Simpson, Maule, and Nicholson, on the expiry of their patent, let the trade go out of the country, and retired with large fortunes. Since then the Germans had controlled the trade, and the English were in their hands; and anthracene, which was produced in larger quantities than was required, had been gradually reduced in price until it had at last come down to the figure of about £10 or £12 a ton. A few years ago—the price had then come down to about £15—the tar distillers formed a Tar Sales Product Committee, and put up the price of anthracene to £30. The largest maker would not join them, but said to them: "We have a quantity of anthracene for sale, and you must give us £35 a ton for it, or we will sell it against you in the market." The Committee bought this anthracene. The largest maker should have been contented with £30 at the outside; but he was not, or they were not. In consequence of their keeping out of the arrangement the tar distillers were unable to continue to hold against the German makers; and now the price had tumbled down to a lower value than ever before. There was no reason whatever why anthracene should be so low in price if the management of the sales had been dealt with in anything like a reasonable way. But there were other things derived from tar. The variety of the sub-products he did not know; nor did anyone present or even in the trade, he supposed, know it was so great. Nearly all the dyes were obtained from it. Lord Lister's wonderful invention, or discovery, which had resulted in such enormous benefit to the world—the antiseptic treatment of diseases and wounds—was dependent on carbolic acid, a coal tar product; and such diverse things as antipyrene and nitrobenzole, which had the perfume of bitter almonds, as well as common things like creosote, were products of tar. In fact, he might say that, if coal tar were not produced by gas manufacturers, it would be absolutely necessary to distil coal solely for the sake of its tar. And yet it was sold at 1d. a gallon—not its value as a mere fuel. They had sold it at 1¼d. a gallon to burn for producing steam; and they intended to try to do what they could again. But what was really wanted was stated in the report, "Some of the causes of these fluctuations are beyond control, but others could be dealt with if the leading gas undertakings would act together." They had thought of inserting in the report, when drafting it, these additional words: "Surely with the prospect, if the present disunion continues, of tar becoming almost valueless on the one hand, and on the other its restoration by co-operation to a price approximate to its real value, such co-operation should not be regarded as impossible of attainment." He believed that it would be possible, by reasonable co-operation among gas manufacturers, to restore tar to something approaching its proper value. When anthracene was first discovered, tar went up from 1d. to 4d. a gallon; and tar products had enormously increased in value since that time. If they could get 4d. a gallon for tar, they would be able to reduce the price of gas by 3d. per 1000 cubic feet, and sell it at 2s. per 1000 cubic feet. If they could get 3d. a gallon, it would enable them to take 2d. per 1000 cubic feet off the price of gas. What was the obstacle to this co-operation? The London make was sufficient almost to control the business; and he was quite certain that the large producers of tar throughout the kingdom, as well as some of the foreign gas companies, would be quite ready to join with them in protecting themselves against the serious loss now sustained by throwing away the tar for next to nothing. The Gaslight and Coke Company used last year 2,060,000 tons of coal; and the South Metropolitan Company, 947,000 tons. If these two Companies could work together, the thing would be done. What was the difficulty? He would not go into this; but he would say that he felt so strongly the necessity of union between the Companies that, if he felt his position as Chairman of the South Metropolitan Company was the obstacle, he should feel it his duty to retire for the general good, because union was so absolutely necessary. (Voices: No, no.) He should, if he felt he was the obstacle to united action on the part of the Gas Companies; if that were so, he should feel it his duty to leave them. But he was not the obstacle. Lately a use had been discovered for a constituent of gas—cyanogen. Cyanogen was the best material for the extraction of gold from its ore; and a considerable demand had arisen. He believed that at first gold-mining people were willing to pay 2s. a pound for it. The gas manufacturers who went into the production of it made too much, as usual, and brought the price down to 6d. per pound. A little while ago the largest makers—it was always the largest makers—sold at 3¾d. a pound; and thus they had made it not worth the while of anyone to go into the business at all. These were the grounds on which he said that united action among the leading gas undertakings was necessary; and until they got it, they would be in a far worse position than they need be. The price of gas might be reduced all over the kingdom if they could but act reasonably together. Paragraph 2 of the report spoke for itself. It mentioned that they had had an increase of rather over 6 per cent. in the quantity of gas sold. Paragraph 3 might be of interest to them. Perhaps some of them might say: Why do you always want to talk about the labour question? Well, in the past half year they had paid about £180,000 in wages, which was by far the largest item of expenditure with them, next to coal, which had cost £243,000. They paid, as he had said, about £180,000 in wages; and other charges were practically nowhere compared with coal and wages. This was a very important matter, and important in this way—that while the Directors were perfectly ready and desirous to give a fair wage for fair work, it was their duty to see that they got the fair work for the fair wage; and he thought he might say, generally speaking, that they did get it. They were all of them greatly indebted to the Federation of Engineers for the great work which they had accomplished in regard to labour and capital. The Federation had been benefactors to employers; and they had not been the less so to all workmen, if the latter could but see it. The Socialistic Unions for years had encouraged the men to do as little work as possible; having taught that the less work they did, the better for their class. The Federation of Engineers had shown the fallacy of this. The Engineers' Society repudiated, by their officers, any desire to restrict production, but this was not in accord with the action of their members prior to the strike. Their Company did not grudge the heavy cost of labour; but he drew attention to it, as showing the effect of this item on the prosperity of the Company. If they got value for the £180,000 he had mentioned, they would be prosperous; if not, they would most surely go downhill. The paragraph he was referring to in the report gave a little information about the result of their employees' investments. They had invested in the Company's stock to the value of £69,000; and beyond this there was the superannuation fund, which was established a great many years ago for the workmen. The capital of this fund was also invested in the Company's stock, another £34,000, and bringing up the total amount invested in the Company's stock belonging to their employees to £103,000. Besides this, £37,000 was in the hands of the Company on deposit. This was pretty good security—a kind of hostage—which they held, and were pleased to hold; and he believed the employees were glad to have them hold it. The latter part of the paragraph referred to a rather interesting fact which had taken place recently. When they began taking these deposits under the profit-sharing system, they agreed to pay 4 per cent. interest on the money, because the rate of interest which they were at that time paying on their new capital was about 4½ per cent. As the proprietors were aware, this rate had fallen very materially—to less than 4 per cent. As the report said "the question was explained to the workmen's representatives, who unanimously agreed that it would be right to reduce the rate of interest." They understood the question from a business point of view, and agreed to recommend the workmen to accept it. They did accept it without a single question; and none of them had withdrawn their money in consequence. A few hundred pounds had been taken out for investment in the Company's stock, and that was all. There was another fact of some interest, which he might make public. At the time the Workmen's Compensation Act was being passed, they called their people together with the idea of forming a fund to meet the Act—in fact, to contract out of it. Instead of being liable under the Act for compensation payable by its clauses, they made an arrangement with their workmen whereby a mutual fund should be established to meet all claims. The Compensation Act provided nothing at all for the first fortnight. The past six months' working of the arrangement had resulted in this way. They had had 3815 men subscribing to the fund; and they had paid in compensation £387, or equal to 2s. per man for the half year, or 4s. per man for the year. One penny a week per man had covered all the compensation required in the six months. The men, however, had only paid ½d. a week, and the Company 1d.—making 1½d. in all. The other ½d. went to pay pensions for certain widows whose husbands lost their lives in past years in the Company's service. As he had said, £387 was paid in compensation to their workmen for accidents, and £171 was paid to the widows; at any rate, 1½d. per man per week was sufficient, so far as the last six months' working had shown, to provide all the compensation necessary; and it was considerably more than was given under the Act. He might say that these figures were a fair average corresponding very nearly with those of the last four years. He could never speak well when he had a successful report to deal with; but he would close his desultory speech by saying that they had to recommend a satisfactory dividend—the same as last—and there was no idea on the part of the Directors of increasing it. It was true the price at which they were selling gas entitled them to pay 5½ per cent., whereas they paid only 5¼ per cent. They thought they acted wisely in not increasing the dividend when they reduced the price. Had they done so at that time, they would have had to dip into their reserve fund; whereas the last four years they had considerably increased it, and they had not had to touch it at all. The dividend was before equal to £5 4s. per cent., but it was now 5¼ per cent., and they had every cause to believe that it would be maintained at this rate. There were

very important reasons why the dividend should be kept at a uniform rate; and the policy of the Board was never to increase it unless and until they could see their way to maintain the increase. They had induced—perhaps the word was a little too strong—the consumers to invest their savings or their money in the Company's stock; and many thousands of them had done so. They told them what dividend was paid; and they felt that it would be a very serious matter if the dividend were reduced. They were therefore determined, so far as they could, to do nothing to jeopardize it in any way. The sliding-scale did not require them to pay a higher dividend, if they did not think it desirable to do so. It simply said that, if they increased the price, the dividend "shall" be reduced; but if they reduced the price, the word "may" increase the dividend was used. They did not think that the time had come to raise the dividend; and therefore they came before the proprietors recommending a distribution of 5½ per cent.—the same as had been paid for the last two half years. When they saw a reasonable prospect of maintaining an increase, the proprietors might be perfectly certain that the Directors would put the dividend up, but not until then.

Mr. Robert Morton seconded the motion.

The Chairman, in answer to a shareholder, stated that if the question of purchasing the Gas Companies arose—of which, however, there was not the slightest probability, though it was just possible—the principle adopted had always been to base the price on so many years' purchase of the dividend.

The Shareholder: And therefore in that case, if you pay a less dividend than you might, you stand in a worse position?

The Chairman: Yes, that is so.

Mr. Hamilton said that the Chairman had apologized for what he had termed the somewhat rambling nature of his remarks; but he did not think that any proprietor present had any reason to complain on that head. On the contrary, he thought they would agree with him (the speaker) that what the Chairman had said was not only very pleasant, but very clear. He had been a proprietor in the Company for many years; and though he had never seen Mr. Livesey, he had always had the greatest admiration for the manner in which he had conducted their Company. He had not only shown himself to be a splendid Chairman, but he had also solved one of the most troublesome questions of the day—how to bring about good feeling between capital and labour. He thought that the Chairman's remarks had shown them that he had solved the difficulty to a great extent; and if the feeling of the meeting was any satisfaction to the Chairman—as he was sure it would be—Mr. Livesey would go away with the knowledge that the proprietors cordially supported him in what he had done. The Chairman had mentioned something (in, perhaps, a jocular way) about resigning.

The Chairman: Remember that there was an "if" about it.

Mr. Hamilton said he hoped that the word "if" would be underlined and put in full capitals in the report of their meeting; for they hoped that Mr. Livesey would remain at the head of their affairs for a great many years to come. (Cheers.) What was more, the feeling of the meeting was to back him up in the negotiations which he had hinted at with other Companies with a view to increase the price they might be able to obtain for their residual products. This was very important, as the Chairman had said; and the proprietors would be very glad to hear if he could bring these negotiations to a successful issue.

The Chairman: I am sorry to say that they are not begun yet.

Mr. Hamilton said that they should be pushed on. They knew that combinations did exist, and sometimes they were successful; but if the largest people interested in any particular trade did not co-operate, the negotiations must naturally fall through. The Chairman had mentioned one Company which did not seem at present desirous of co-operating. It was a great pity for the welfare of that Company that they did not join in the proposal which Mr. Livesey put before them. This, however, was a point which they could leave in the hands of such an able general as Mr. Livesey—a man so full of tact and resource, that if anyone could bring the matter to a successful issue he would do so. Something was said in the Directors' report about the weather.

The Chairman stated that they had not "complained" about it.

Mr. Hamilton (continuing) remarked that the weather, although exceptionally mild, had not been very healthy; but he thought that one of the reasons why the use of gas had fallen off to a certain extent was the absence of dense fogs. He remembered a few years ago when there was a fog it *was* a fog, and they had to light up gas all over their houses. This year, however, they had had no such fog, but only little mists; and the consumption of gas had therefore fallen off. He attributed a great deal of the absence of fog in South London to the use of gas-kitcheners. Coal not being burnt, there was less smoke; and they were thus benefactors to the human race. The proprietors would not quarrel with the Directors if, in the plentitude of their wisdom, they in future years paid a dividend of 6 or 6½ per cent.; but he quite agreed with the remark of the Chairman that it would be a very bad thing for the Company to pay 10 per cent. one year and nothing the next.

Mr. Bryan Donkin called attention to a diagram which he had prepared showing the effect—it was understood—of the Directors' policy in the past ten years in regard to the business.

The Chairman then put the resolution to the meeting; and it was carried unanimously.

On the motion of the Deputy-Chairman (Captain T. B. Heathorn, R.A.), seconded by Mr. J. Ewart, a dividend was declared at the rate of 5½ per cent. per annum; and resolutions were afterwards passed re-electing the retiring Directors (Mr. John Mews and Mr. Simpson Rostron) and the retiring Auditor (Mr. William Wescott, F.C.A.).

The Chairman then moved—"That the governor house, No. 626, Woolwich Road, Charlton, and the premises at Blackwall Lane, East Greenwich, which have been for some time in the occupation of Messrs. Courage and Co. as tenants of the Company, are not required for the purposes of the Company's undertaking; and the Directors are therefore authorized to sell and dispose of the same in such manner as they may determine." As a matter of fact, he remarked, they had sold both these properties; but they required the proprietors' authority.

Mr. E. H. Cardwell seconded the resolution, and it was carried.

The Chairman, in reply to a hearty vote of thanks to himself and his colleagues, expressed the gratification which the Directors felt at the cordial way in which they were always received by the proprietors—a reception which gave them new heart and encouragement to do the best they could for the Company. He would not have them suppose for a moment that he thought of resigning or retiring; for, so far as worldly things were concerned, his connection with the undertaking was his greatest pleasure. He afterwards referred in warm terms to the invaluable services rendered by the officials and the employees generally, and proposed a vote of thanks to them. The great reason why they were in so sound and prosperous a state was that they were backed up and supported by as thoroughly loyal and earnest a set of officers as it was possible to find anywhere. Their foremen also were rendering devoted service, as well as their men. Perhaps a few of various ranks were not animated by the spirit which they ought to feel towards the Company; but, speaking generally, a good spirit greatly predominated.

The motion was seconded, and carried unanimously.

The Chief Engineer (Mr. Frank Livesey), in reply, assured them that they were working unitedly together to do their best to reduce the price of gas. That was their chief aim; but at the present time they were a little handicapped by the low return for residuals. They were reconstructing their retort-houses, though not quite so fast as they would like; but he was quite sure that from what they were doing they would reap great benefit in the future. The profit-sharing scheme was a very great success—not only among the officials, but throughout the ranks. He had received most valuable suggestions from foremen and workmen.

The Secretary also acknowledged the vote. He remarked that two matters stood out prominently in the accounts—the satisfactory increase of 6 per cent. in the gas sold, and the fact that the dividend just declared had been more than earned, for they had made up a deficiency of £5200 owing on the previous year. He thought it must be regarded as very satisfactory that carbonizing wages had gone down to the low point at which they now stood.

The proceedings then terminated.

CRYSTAL PALACE DISTRICT GAS COMPANY.

The Half-Yearly General Meeting of this Company was held last Friday, at the Albion Tavern, Aldersgate Street, E.C.—Mr. George Livesey presiding.

The Secretary (Mr. Charles M. Ohren) read the notice convening the meeting; and it was agreed to take as read the report and accounts, of which an epitome appeared in the "Journal" last week.

The Chairman first of all alluded to the use made of his name in the prospectus of the Patent Gas Enrichment Syndicate, Limited—speaking in much the same terms as he did at the meeting of the South Metropolitan Gas Company the previous Wednesday (see p. 411). Proceeding to move the adoption of the report, he said the first paragraph referred to the financial position of the Company and the working during the half year. The actual financial position was not so satisfactory as they would have liked. As was clearly shown in the report, they had not earned the dividend. He believed he told the proprietors at their last meeting that he did not expect they would do so. They might say: "Then give us an explanation why we have not." The other day he heard rather a good remark from a friend of his. He said that explanation of failures was the easiest thing in the world; but explanation of success was not so easy. He (the Chairman) supposed the reason was that no one wanted to explain success; but practice gave facility in explaining failure. He did not admit failure; but he did admit they had not earned their dividend. He would give one or two reasons as to why this was so. First, the expenditure under the head of manufacture had been higher. Something like £2000 more had been expended on the repair and maintenance of works. This was necessary; and it would be necessary for some time to come, in order to put the plant in such a condition that it would be able to produce gas at the lowest possible rate. Expenditure of this kind was perhaps the most productive they could make—in fact, he might say that only that day they had passed resolutions ordering machinery to the extent of about £5000. That for their new retort-house would be charged to capital, and that for the old retort-house (being in substitution of worn-out plant) would, of course, be charged to revenue. A sum of £1200 would have to go to revenue; and £3800 to capital. This expenditure would be undoubtedly productive, as it would enable them to reduce their carbonizing wages. As he had said on another occasion, when the Gas Workers' Union came into existence, the work was altered from the two-shift to the three-shift system. Prior to that the wages of this Company worked out to 2s. 4d. or 2s. 5d. per ton of coal carbonized; but they immediately went up another 1s.—to 3s. 4d. or 3s. 5d. In the past half year, the amount was just 3s. 4d. per ton. They wanted to reduce this. He had no doubt that some of their men would read his remarks; and he was going to give the stokers a friendly hint. He did not think the stokers were doing the best they could for the Company. They might put more interest into their work, and effect some saving in the item of carbonizing wages. The Directors expected that they would do so. He was sorry to say the working man had been so indoctrinated with the teaching of Socialistic unions, that the less work they did the better it would be for them, that the idea of restricting work was becoming common. He did not say it was so generally in their case, but he did say there was a taint of it. He would therefore give the men the hint that the Company expected them to give an honest day's work for a fair day's pay; and he had no doubt their Engineer would see they did it. The Directors intended to treat the men fairly and even liberally; but they meant also to see that the men treated the Company justly. He thought he might say that the majority of them did. But there were men who had fallen into a slipshod way; and they must get out of it. The item of salaries of Engineer and officers at works was higher; but included in that was a sum of £500 paid to their late Engineer. They paid him up to the end of last year; and £500 was the amount of his half-year's salary, but it would not appear in the accounts again. The £2000 odd extra on repairs and maintenance, the £500 in the item of salaries, and a few smaller sums made nearly £3000; whereas their deficiency was rather more than £4000. The deficiency was due partly to the low price of residuals. Here he had to deal with a rather serious matter. They had seldom received for residuals so small an amount per ton of coal carbonized as in the past half year. The receipts for residuals in the six months only averaged 6s. 7d. per ton of coal, as against 6s. 11d. in the corresponding period of 1896. In the

June half of last year, they were as low as 5s. 6d.; so that they were on the mend. But this drop in residuals was very serious for gas companies; and he felt sure it was much greater than it need have been if the business had been properly managed. He had spoken in another place about coke, showing how, by the accumulation of large stocks (this Company never accumulated stocks), the market price had been depressed—unduly and unnaturally depressed; and it took a long time to recover from such depression. He had also on another occasion spoken about tar; but he would deal now more particularly with sulphate of ammonia. About Midsummer 1894, sulphate was selling at £13 15s. per ton. The largest makers were not satisfied with this, and asked for £14. The market would not give it; £13 15s. being an extremely good price. The people who wanted the higher price accumulated a stock of some thousands of tons; and in October they had to sell it at £13. They again went on accumulating a considerable stock, and held out against the market. By the end of December, another large stock was on hand; and they then had to sell at £11. So, on and on, the market went down from £13 15s. to £7 or so. When he told the proprietors that £7 per ton was quite an unprecedented price, and moreover it was lower per ton than the price of nitrate of soda, and when it was remembered that the latter was worth in its ammonia value £2 per ton less than sulphate of ammonia, they would at once see that for sulphate to go below the price of nitrate was a most extraordinary circumstance; and he attributed it entirely to the accumulation of these large stocks. The stocks were on hand; and in time the buyers of sulphate came to know, or they had the feeling, that these stocks might be thrown on the market at any moment, and that if they committed themselves in any way they might be losers. Instead of having gone below £7 per ton, sulphate ought not to have fallen lower than £9. However, as soon as the stocks had all gone—this was a few months ago—the price immediately began to rise; and it had gone up about £3 (from £7 to £10) in six or seven months. There was one other circumstance that had helped it to some extent. There had been formed (and the Company had been very glad indeed to become subscribers to it) a Sulphate of Ammonia Committee for the purpose of making known the advantages of sulphate of ammonia among agriculturists and others in this country. The Committee had been in existence for about nine months, and had undoubtedly done good work. Their work and the clearing away of the stocks were, he believed, the main causes of the price of sulphate of ammonia going up so materially. What he was particularly anxious for was that gas companies should all pull together; and until they did so, they were at the mercy of speculators—helplessly and hopelessly at their mercy. As to the working of the half year, he might say generally that it had been satisfactory. They had certainly produced more sulphate per ton of coal than they had been in the habit of doing; but there was room for further improvement. The best working was a production of a ton of sulphate from 97 tons of coal; but anyway they ought at least to get a ton of sulphate from 100 tons of coal. They had reached as high as 140 tons of coal to a ton of sulphate; but one half year it was more than that even—160 tons. Now they had got down to 118½ tons; and he should be much surprised if their Engineer was satisfied before he reached the recognized standard. He (the Chairman) thought he might say that, although there was a deficiency on the revenue account, there was nothing to cause the slightest uneasiness. They had an ample reserve fund, on which they had drawn to make up the deficiencies, and they would probably continue to do so for the next half year or two rather than increase the price of gas. From what they could see, there were great possibilities in their working. The very fact that the working had been unsatisfactory was an assurance that, by its being placed on a satisfactory footing, they would recover all their losses from imperfect working. They had an increasing business, though it had certainly not increased very much during the past half year—only some 2½ per cent. But they must not complain of this. The seasons varied; they had a cold season one year, and a mild one another. Probably next winter would be cold, and then there would be a large increase in the consumption of gas. The dividend the Directors proposed was the same as on the last occasion. The proprietors were entitled by the price of gas to ⅛ per cent. more, or £5 7s. 6d.; but the Directors were only recommending 5¼ per cent. He thought the shareholders would be satisfied with this, when they were assured that the Directors were not going to exhaust the reserve fund. It was absolutely essential for the prosperity of a gas company, if they wished to hold their own in these days, that they should sell gas at a low price. When the Directors reduced the price from 2s. 9d. to 2s. 7d., they did it on the strength of a good market existing at the time for their residual products. The market, however, had gone to pieces; and the 2s. 7d. was not enough. But they felt it would be far better to go on drawing on their ample reserve fund for another half year or two than raise the price of gas. It would be a most disastrous policy to do that; it would be playing into the hands of their rivals in the worst possible way for the Company. He felt it right therefore to tell the proprietors that the reserve fund was sufficient to meet a considerable drain yet. They had still £32,000 odd left; and under these circumstances he was sure they would be satisfied it was wise policy to continue to sell gas at the present price. Looking to improvement in the future, they hoped to restore the concern to its old position.

Dr. Frederic Hetley seconded the motion.

Mr. Woods called attention to the unaccounted-for gas in the half year, which, he said, appeared to work out to about 8 per cent. This was rather large, and amounted in value to between £6000 and £7000 a year. In reference to prepayment meters, he had heard that in some districts in London there had been considerable loss in connection with the system. He also asked for information as to the profit-sharing scheme.

Mr. A. Mack suggested that any servant of the Company who did not perform his work properly should be exempt from the profit-sharing system. This would be a just and proper punishment, and would be a warning to others.

The Chairman explained that it was impossible to ascertain, with any approach to accuracy, what was the actual amount of the unaccounted-for gas by taking a single half year; they must take the whole year. If they could have all the indices of the meters read on June 30 and Dec. 31, they would get the amount exactly; but the taking of the indices occupied about three weeks—ten days before the close of the half year, and ten days after. Therefore, in the June half year, they gained a portion of the winter (December) consumption and lost a portion of the summer; while in the second half, they lost a portion of the winter consumption, and gained a little of the summer. It was therefore necessary that the whole year should be taken in considering the unaccounted-for gas; and then it would be found that the percentage was not so bad. It was 7¼ per cent. for the past half year, and only 4 per cent. in the June half, which made rather more than 5½ per cent. for the year. This was about 1 per cent. more than he liked to see; but it was an improvement on the previous year, when the average was 7 per cent. It must, however, be remembered that this unaccounted-for gas was not all leakage. A gas-meter was not like a scientific man's balance. A meter was stamped as correct if it did not register more than 3 per cent. against the Company or more than 2 per cent. against the consumer; so that there was a range of 5 per cent. in the meter. Then the gas was measured at the works at a higher temperature than at the consumers' meters; so that there was a reduction in bulk. What the amount of absolute leakage was, nobody knew. If the unaccounted-for gas amounted to 5 per cent., the leakage proper would not perhaps be more than 3 per cent. As to prepayment meters, the number fixed on Dec. 31 was 6738; and of these 960 were added during the half year. On these there was no loss. The Chairman then explained the profit-sharing system under which the Company worked; and afterwards, alluding to Mr. Mack's remarks, said he wished it to be understood that he had not been making sweeping charges against the men generally—only some of them had got into a loose way of doing their work. It was difficult to get all of them to put the proper quantity of coal into the retorts; and this was one reason why they were going in for the adoption of machinery. It was very proper to say the bonus should not be given to the men who did not work carefully. He was sorry to say the profit-sharing system had not been the success here that it ought to have been, because, in the first place, it was given indiscriminately—every man having been allowed to renew his yearly agreement as a matter of course. Their Engineer, however, would take care that those men who had not been working fairly were not allowed to sign fresh agreements on their present ones expiring; and this would exclude them from profit-sharing.

Mr. Woods thought the Chairman's statement most satisfactory.

The resolution was unanimously carried.

Dividends at the rate of 5 per cent. per annum on the preference stock and 5¼ per cent. on the ordinary stock were next declared.

On the motion of Mr. Frederic Lane Linging, seconded by Mr. A. T. Layton, Mr. Livesey was re-elected to his seat at the Board, as was also Dr. Hetley, on the proposition of the Chairman, seconded by Mr. James Glaisher.

The outgoing Auditor (Mr. A. G. Hounsham) was next re-appointed on the motion of Mr. T. Guyatt, seconded by Mr. Westcott.

Votes of thanks were passed to the Chairman and Directors, and to the Engineer (Mr. Shoubridge), Secretary, and their respective staffs.

Mr. Shoubridge, in his reply, remarked that he was glad to take the opportunity of saying that he believed the employees generally were working most heartily and loyally to bring about a better result. It was his opinion that the Company had now touched bottom, and that they would go on year by year steadily, if not rapidly, improving in results until they again stood in the front rank of the best-managed gas companies in England.

Mr. Ohren also acknowledged the vote.

LIVERPOOL UNITED GASLIGHT COMPANY.

The Half-Yearly Meeting of this Company was held last Tuesday—Mr. Edward Lawrence presiding.

The Secretary (Mr. P. F. Garnett) read the report of the Directors, which recommended the payment of a dividend for the half year ending Dec. 31 of 5 per cent. on the ordinary consolidated stock and 3½ per cent. on the consolidated 7 per cent. stock.

The Chairman, in moving the adoption of the report, expressed the deep regret of the Board at the loss they had sustained by the death of their colleague Mr. Hugh Perkins. The deceased gentleman had served the Company very faithfully; and his advice was always sound, and tempered with good judgment. Proceeding, the Chairman said the Directors felt justified in recommending the payment of the statutory dividend as usual. The working of the concern for the half year had been eminently satisfactory, though it had presented a curious example of somewhat rapid changes in the consumption of gas. During the previous year they witnessed a very large increase in their consumption. Throughout the whole of the earlier part, or probably more than half, of the past half year, the increase went on; and it looked as if they were going to close the six months with a consumption very largely in excess of the previous year. But, as the proprietors knew, the past winter had been an extraordinary one; the idea of frost and snow seemed to have vanished almost from this hemisphere, with the result that the demand for gas had been most materially reduced, and the increase, which at one time they hoped might be permanent, gradually disappeared towards the close of the half year. On Dec. 31 the consumption was just about the same as it had been for the six months in the previous year. Still, they had every reason to be satisfied, although in another respect they had to bear with some disappointment. What he had to say regarding their own Company was borne out by the experience of almost every gas company in the country—that was, they had found the consumption of gas reduced, and the price of residuals affected. These were always serious matters for gas companies. On the other hand, they had reason to feel pleased that the price of the material they had carbonized had been less than in the corresponding half year; and the result was that they closed the half year with comparatively little difference from the position they were in then. In the past six months, everything had gone on perfectly smoothly and satisfactorily. They had so adjusted their relations with the public that the latter had no cause for complaint. He did not know that there ever was a time when they had been freer from those little troubles which were constantly cropping up between gas companies and consumers. As far as they could tell, everybody was satisfied with the article they were now providing for the purposes of illumination. While they recognized that in the electric light they had a formidable competitor, he did not know that there was any reason to fear it. The Corporation were doing their best to spread the consumption of electricity; but up to the present it had not interfered with the Gas Company to their disadvantage. This

showed that there was room for both of them. With the improving trade they might look forward to, there was every ground for hoping that the prosperity of the Company would be just as great in the future as it had been in the past.

Mr. J. B. SMITH seconded the motion, which was carried.

The dividends recommended were also declared; and a vote of thanks was passed to the Chairman and Directors for their services.

SHEFFIELD UNITED GAS COMPANY.

The Half-Yearly Report and Accounts.

The chief feature in the report of the Directors of the above-named Company which will be presented at the half-yearly meeting on the 14th prox. is the announcement, referred to in another part of the "JOURNAL," that, in pursuance of the policy they have always adopted, to lower the price of gas whenever the funds permit, they have decided to make a reduction of 1d. per 1000 cubic feet as from April 1. This is equal to 4·16 per cent. on the consumers' gas accounts, and, calculated on the quantity of gas sold last year, will amount to £9034 per annum. The Company's charges will then be 1s. 11d., 1s. 9d., and 1s. 7d. per 1000 cubic feet, according to consumption. The accounts accompanying the report show that the revenue from the sale of gas in the past half year was £109,146; meter and stove rental produced £5874; and residuals, £41,759—the total receipts amounting to £158,692. The expenditure on the manufacture of gas was £86,554 (£43,731 being for coals and £24,636 for the repair and maintenance of works and plant); on its distribution, £10,081; management cost, £4713; and the total expenses were £110,571—leaving £48,121 to be carried to the profit and loss account. The amount available for distribution is £62,536; and the Directors recommend the declaration of the usual dividends, which will absorb £40,630.

BRISTOL GAS COMPANY.

The Half-Yearly General Meeting of this Company was held at the Offices, Canons' Marsh, on Friday—Alderman J. W. S. DIX in the chair.

The report of the Directors, noticed in the "JOURNAL" last week, having been taken as read,

The CHAIRMAN, in moving the adoption of the report and accounts, said the Company started the year 1897 with a reduction of 2d. per 1000 cubic feet on the added area of the city; so that the consumers were now all inside. The increase in stoves was satisfactory—there being an addition of about 1016; and there was also an increase in meters. No doubt all persons who had had the luxury of gas cooking must appreciate it. The Directors wished to afford them every facility in carrying out the arrangement; and they intended in future giving up the price hitherto charged for fixing, if the distance was not more than 50 feet from the main. If people wanted to go a greater distance—say 200 feet—they would have to pay the difference. In addition, the Directors intended to charge half the percentage they had hitherto put on. This was for the high level; so that, according to their present intentions, the cost of stoves would differ from 10d. to 1s. 6d. per quarter.

Mr. P. L. STOTHERT, in seconding the motion, congratulated the Board that they were able to pay the maximum dividend without drawing on the reserve fund, as some other large companies had to do.

Mr. C. NEWTH, in supporting the motion, suggested that meters should be supplied free of charge to gas consumers, as was done in Manchester. He saw that the rents amounted to something under £2000 last half year; and as they carried over a balance of £15,000, the subject was worth consideration.

The CHAIRMAN said the Directors would be very glad to take off the rent of meters. The proprietors must not, however, forget that they received £3600 from this source in a year; and the price they obtained for their residual products was going down. He did not think at the present time it would be wise to do what was asked, if they had to put up the price of gas. They were not a philanthropic Company; but they considered themselves through their customers, and believed that the more they did for consumers the more they did for themselves.

The resolution was put and carried.

The retiring Directors and Auditor were then re-elected, and a dividend at the rate of 5 per cent. per annum was declared.

CROYDON COMMERCIAL GAS COMPANY.

The Half-Yearly Report and Accounts.

At the ordinary general meeting of the above-named Company to-morrow, the Directors will report that the total quantity of gas sold in the six months ending Dec. 31 showed an increase of 1·33 per cent. on that of the corresponding period of 1896. It is explained that the smallness of this increase, as compared with previous half years, arises chiefly from the exceptionally mild weather which prevailed during the winter. The revenue from the sale of gas was £43,513; from the rental of meters, stoves, and fittings, £2462; residuals produced £11,974 (a reduction of £1107 on the returns in the corresponding period of 1896, owing to the depressed state of the tar market); and the total receipts were £58,018. The expenditure on the manufacture of gas was £32,148 (coals costing £22,286); on its distribution, £4372; and on management, £2123—the total expenses being £43,130. The amount carried to the net revenue account is £14,888; and the balance available for distribution is £14,727. The Directors recommend dividends at the rates of 14, 11, and 9 per cent. per annum on the various classes of stock. These will amount to £14,674, and leave a balance of £53. There are now 12,034 consumers on the books of the Company; and of these 8729 have ordinary accounts. The supply of gas through prepayment meters continues to extend. Additional houses to the number of 428 were fitted up by the Company during the half year; bringing the total to 3305. The number of additional gas cooking and heating stoves supplied in the six months was 440; making the total now on hire 4570. A complete plant for the manufacture of carburetted water gas has been erected at Waddon. Under the supervision of the Company's Engineer and Manager (Mr. J. W. Helps, Assoc.M.Inst.C.E.), 30,484 tons of coal, 959 tons of cannel, and 6919 gallons of oil were used in the production of 343,711,000 cubic feet of gas, of which 318,558,200 cubic feet are accounted for. The estimated quantities of residuals produced during the half year were: Coke, 18,866 tons; breeze, 4374 tons; tar, 291,181 gallons; and ammoniacal liquor, 800,008 gallons. There were 275 tons of sulphate made, the whole of which, with some in store, was sold.

TOTTENHAM AND EDMONTON GAS COMPANY.

The Half-Yearly Report and Accounts.

At the Half-Yearly General Meeting of the above-named Company next Saturday, the Directors will report a highly satisfactory increase of 15,018,500 cubic feet—equal to 6·52 per cent.—in the quantity of gas sold in the six months ending Dec. 31, as compared with the corresponding period of 1896. The total revenue was £42,617, of which £36,705 was for gas. The expenditure was £31,188; £21,645 being for the manufacture, and £3933 for the distribution of gas. The balance carried to the profit and loss account is £11,429; and the amount available for distribution is £10,837. The Directors recommend a dividend at the rate of 12 per cent. per annum on the "A" stock, and of 9 per cent. per annum on the "B" and "C" stocks. These will absorb £8700, and leave £2137 to be carried forward. The number of meters in use in the past half year increased as follows: Ordinary, 482, equal to 7·99 per cent.; automatic, 1417, equal to 32·78 per cent. The total number of both kinds in use at the close of the year was 12,252. The number of gas cooking-stoves then fixed and on rent was 1971; the increase over the corresponding half year being 424. The number of public lamps lighted was 2266; being 1105 ordinary 5-feet burners, and 1161 fitted with incandescent burners. The works and plant, under the supervision of Mr. W. H. H. Broadberry, are being maintained in efficient condition. The Directors have recently passed plans prepared by him for the reconstruction of the retort-benches, which will enable them to meet the growing demand for gas for some years to come. There were 11,248 tons of coal and 439,455 gallons of enriching oils used in the manufacture of gas in the past half year; the quantity produced being 260,682,000 cubic feet, of which 249,948,000 cubic feet were accounted for. The following were the estimated quantities of residual products: Coke, 6928 tons 16 cwt. (and, in addition, 161 tons 15 cwt. were bought); breeze, 1474¼ chaldrons; tar, 127,480 gallons; ammoniacal liquor, 3124 butts. There were 102 tons 15 cwt. of sulphate of ammonia made, of which 63 tons 5 cwt. were sold.

PROVINCIAL GAS AND WATER COMPANIES.

Gas Companies.

The accounts which the Directors of the Bath Gas Company will present to the proprietors at the half-yearly general meeting next Friday show a favourable balance of profit. The receipts from the sale of gas in the six months ending Dec. 31 amounted to £27,389; the rental of meters, stoves, and fittings, to £1482; residuals produced £4708; and the total revenue was £33,793. The expenditure on the manufacture of gas was £19,850; on its distribution, £3106; on management, £1444; and the total was £26,397—leaving a balance of £7395 to go to the profit and loss account. A sum of £1800 has been credited to the suspense account; thereby reducing it to £4200. The amount available for distribution is £10,510; and the Directors recommend the payment of maximum dividends. The very mild weather prevailing during the whole of the December quarter prejudicially affected the consumption of gas; but there was an increase in the preceding quarter, as compared with the corresponding period of 1896. With regard to residuals, there was a slight advance in coke and sulphate of ammonia; but a decrease in the returns for tar. Under the supervision of Mr. C. Stafford Ellery, Assoc.M.Inst.C.E., 18,882 tons of coal and 97,362 gallons of oil were used in the manufacture of gas; and of the coke produced (10,866 tons), 2672 tons were utilized as fuel, and 877 tons in the production of oil gas. There were 996 tons of tar and 515,000 gallons of liquor produced; 511,000 gallons of the latter being used in making 164½ tons of sulphate of ammonia.

A satisfactory report was submitted by the Directors of the Bromsgrove Gas Company to the shareholders yesterday week. It showed that the result of the past year's business had enabled the Directors to recommend a slight increase in the dividend, to transfer £250 to the reserve fund, and to carry forward a balance. The available amount for distribution was £1670, out of which it was proposed to pay a dividend of 7½ per cent. on the ordinary shares and 7-10ths of 7½ per cent. on the "B" shares. The report was adopted, and the dividend declared.

The first annual general meeting of the Cannock, Hednesford, and District Gas Company was held on the 14th inst., at the Company's offices, Cannock, when a dividend of 5 per cent. was declared. The Company is the outcome of an amalgamation of the Hednesford and Cannock Companies, which was carried out twelve months ago. The price of gas was reduced by 5d. per 1000 cubic feet in the Hednesford Company's district as soon as the fusion took place. The make of gas in the whole district for the past year was just over 26 million cubic feet; being upwards of 2 millions in excess of the previous year.

At the annual general meeting of the Canterbury Gas and Water Company on the 28th inst., the Directors will report that, notwithstanding the price of gas was reduced last year 2d. per 1000 cubic feet, there was an increase of about 2 per cent. in the sales. The system of supplying gas by prepayment meters was introduced in September; and a large demand has been created by this class of consumers. There is a balance of £5119 standing to the credit of the profit and loss account, after providing for payment of the interest on the loan capital and the transfer to the dividend account of the sum authorized by the Company's Act of 1890. The sum standing to the credit of the dividend account, after payment of the interim dividend is £5021 and a dividend of 4½ per cent. is proposed; making with the interim dividend of 4¼ per cent. paid on the 30th of August last 8¾ per cent. for the year. The period for which the sum of £6500 was raised on mortgage of the Company's water undertaking expires on the 1st of September next; and the Directors propose to ask for the necessary consent of the shareholders to convert this loan capital into consolidated "B" stock.

The annual general meeting of the Carmarthen Gas Company was held on the 11th inst.—Mr. C. W. Jones in the chair. The Directors reported that the quantity of gas sold last year was 16,951,000 cubic feet, as compared with 16,842,000 cubic feet in 1896; the coal carbonized being 1819 tons, against 1797 tons. They expressed their pleasure in announcing that there would be a further reduction in the price of gas from the 31st prox. of 2d. per 1000 cubic feet; making the price 4s. for lighting, and 3s. 6d. for cooking and other purposes. The profits for the year were £1399; and the amount available for distribution was £1237. Dividends at the rates of 7½ and 7 per cent. per annum (the payment of which would absorb £978), and the placing of £200 to the reserve fund, were recommended. The report was adopted, and dividends at the above-named rates were declared. Thanks were accorded to the Manager and Secretary (Mr. B. A. Lewis), for his efficient services, whereby, since his appointment in 1892, the price of gas has been reduced from 5s. to 4s. and 3s. 6d. per 1000 cubic feet, while the dividends have been raised from 4⅜ and 5 per cent. to the maximum rates of 7 and 7½ per cent., the reserve fund has been increased £416, and the working balance £193.

The annual meeting of the Derby Gas Company was held last Wednesday. Mr. Henry Swingler, who presided, said that although new works which they had erected had involved a large expenditure, they had proved of a remunerative character. The price of residuals had increased; and in consequence of the engineers' strike, the Company had been sending coke all over the country. The strike of their own men last April had cost £3000; but affairs had now settled down satisfactorily. The expenditure on capital account was £4765, a large portion of which had been spent in laying down a new main for an outlying district. But for the strike, they would have made a net profit of £2500. He dwelt upon the success of the penny-in-the-slot system and the supply of gas-stoves, and said that the Directors, if necessary, would adopt every improvement possible to compete with the electric light, though he contended that there was room for both gas and electricity in the town. Dividends at the rate of 10, 7, and 5 per cent. were declared upon the various stocks.

The revenue account of the Eastbourne Gas Company shows a profit for the past half year of £5203, which, added to £11,889 brought forward and £79 received for interest, makes a total of £17,171 to the credit of the profit and loss account. The Directors recommend a dividend for the half year at the rate of 14½ per cent. per annum upon the £20,000 original capital and also upon £12,490 raised on "C" shares, and at the rate of 11½ per cent. on £65,000 paid up on "B" shares, which will absorb £6093, and leave a balance of £11,078 to be carried forward. These dividends are ½ per cent. more than at any previous period. The Directors, after full consideration, have unanimously resolved that the Secretary should have an increase in his salary of £200 per annum; and they recommend the confirmation of this increase.

The report to be presented at the meeting of the Harrogate Gas Company next Monday shows an increase of 16,886,000 cubic feet in the consumption of gas last year; being rather more than 10½ per cent. in excess of that of the preceding twelve months. The Directors express their pleasure in stating that there was "exceptional activity, progress, and prosperity in every department of the Company's business." The sale of gas produced £22,908; residuals brought £5510; and the total revenue was £31,082. The expenditure on the manufacture of gas was £15,686; on its distribution, £1410; and the total expenses were £20,034—leaving £11,048 to go to the profit and loss account. The balance available for distribution is £8268; and the Directors recommend the same dividends as those declared this time last year. Under the superintendence of the Secretary and General Manager (Mr. H. Wilkinson), the works carbonized 18,502 tons of coal and only a single ton of cannel—a "record," we should think, in the annals of gas manufacture; the residuals produced being 11,546 tons of coke, 1113 tons of tar, and 2215 tons of 5° liquor.

The Directors of the Ipswich Gas Company in their annual report state that a large addition to the number of consumers has resulted in greatly increased receipts from the sale of gas; but, as a set off to this, less has been received for residual products, and the expenditure for the year has been heavier. The net result is that the profit and loss account shows a balance of £14,241, as against £13,707. Of this amount £4826 had been applied in payment of an interim dividend at the rates of 12, 9½, and 9 per cent. on the "A," "B," and "C" stocks respectively; and the Directors now recommend a further dividend at the same rates. A balance of £4532 will then remain. Having alluded to the satisfactory completion of the new gasholder, the Directors state that the Docks Commissioners decided in September last to discontinue the drawback allowed to the Company on coke exported beyond the borough boundaries. These drawbacks have hitherto amounted to about £300 per annum, which amount the Company will now probably lose.

The annual meeting of the Longwood Gas Company was held at the offices last Thursday. Mr. E. Armitage, the Chairman of the Company, presided, and, in moving the adoption of the report, congratulated the shareholders on the result of the past year's working. The increased consumption of gas had, he said, been 4,458,000 cubic feet, which was at the rate of 11 per cent. The leakage had been reduced 3½ per cent.; while the make of gas per ton of coal was 10,394 cubic feet—an increase on the previous year of 704 cubic feet per ton. The number of additional consumers was 401; the total at the end of the year being 2809, of which 332 were served by prepayment meters. The quantity of coke used for fuel was 736 tons, against 840 tons in 1896. During the year the Directors resolved on letting gas cooking-stoves on hire; and 93 had been fixed. It had also been decided to lay services and fix meters free of charge, and supply free with prepayment meters a small griller. The works were capable of manufacturing nearly double the present quantity of gas, and consequently the consumption would be fostered in every possible way. Much credit was due to their Manager and Secretary (Mr. J. H. Brearley) for the manner in which he had conducted the concern, and the untiring energy he had displayed. Mr. R. Thornton, the Vice-Chairman, seconding the motion, spoke of the bad state of the residuals market, particularly with respect to tar. There was, however, he said, a more hopeful sign in regard to sulphate of ammonia. The report was adopted, and the usual dividends (for which a sum of £2216 was available) were declared; after payment of which there would be a surplus of £1511 to be carried forward.

In the annual report of the Directors of the Newcastle and Gateshead Gas Company they state that the revenue last year amounted to £246,356; the expenditure, to £182,952—leaving a balance of £63,404. Adding the £7409 brought forward, there is a total of £70,813 available for interest and dividends. These will absorb £67,731, and leave £3082 to be carried forward. The extensions which the Company have in hand have, owing to favourable weather, progressed satisfactorily. The new retort-house at Redheugh will be in partial use next winter. The continued growth of the population and increased demand for gas has rendered it necessary to commence immediately the erection of the new works at St. Anthony's, for which powers were obtained by the Act of 1896. Purchases of the land required are in course of arrangement; and the erection of a gas-holder of 5 million cubic feet capacity will be commenced as soon as possible, to be followed by the construction of manufacturing plant. The extensive works undertaken by the Company will necessitate a large expenditure of capital, a considerable portion of which will be unproductive of revenue until gas is made at St. Anthony's. The Directors consider, therefore, that it may become necessary to make a small increase in the price of gas.

At the annual general meeting of the Newmarket Gas Company on Monday last week, the Chairman (Mr. R. Stephenson, J.P.) moved the adoption of the report of the Directors, which was noticed in the "JOURNAL" a fortnight ago. Referring to the proposal to put £600 to an insurance fund, he explained that this was a new fund so far as the Company were concerned; but it was deemed necessary to form it, as it would enable them to meet unforeseen contingencies. With regard to the reduction of 2d. per 1000 cubic feet in the price of gas, it would mean a saving of £380 to the ordinary consumers, supposing the consumption was the same as it had been. If an electric light company were started which took away any of their customers, the 2d. would go on again under the sliding-scale, and they would lose the £380 now given to them. Mr. Rodrigo urged that the reduction made on the gas-engine rates should apply also to cookers. The Chairman said the reason for not including cookers was that they were mostly used in the evening, whereas engines consumed a large quantity of gas principally in the daytime. The Manager and Secretary (Mr. J. H. Troughton) pointed out that though, in many provincial towns, gas for cooking purposes was sold at a cheaper rate than that used for lighting, it was mostly in cases where the companies were not under the sliding-scale. Mr. Rodrigo expressed the opinion that the Directors were not pushing gas-cookers so much as gas-engines. The Chairman thought the question raised was one for the Directors to consider. The report was adopted. At the close of the meeting, a sum of money was, as usual, subscribed for the different classes of men employed on the works.

The half-yearly meeting of the Newport (Mon.) Gas Company was held on Monday last week—Mr. J. Phillips in the chair. The Directors in their report recommended the payment of the usual dividends; but, in order to do so, it would, they said, be necessary to take £718 from the profit and loss account. The Chairman, in moving the adoption of the report, said the mild weather during the winter had interfered with their returns, and they were obliged to draw on their reserve to pay the dividends. During the past half year, £805 had been spent on manufacturing plant, as compared with £25 in the second half of 1896. A much larger number of mains had been laid than in the corresponding period of the previous year; the Corporation being desirous that there should be extensions to districts now in the borough. There had been heavier charges for coal; and rates and taxes had considerably increased. In conclusion, he made special reference to the excellent services rendered to the Company by their Engineer (Mr. T. Canning, Assoc.M.Inst.C.E.) and their Secretary (Mr. E. F. Marfleet). The report was adopted.

The ordinary general meeting of the Redhill Gas Company was held last Thursday evening—Mr. J. Lees, J.P., in the chair. The Directors reported that the consumption of gas continued to increase, and that there was a balance of £5275 available for distribution. A dividend at the rate of 5½ per cent. per annum was recommended for the six months ending Dec. 31; making with the interim dividend paid in September 10 per cent. for the year. The lighting of some of the roads by incandescent burners had been successful; and the Corporation had extended the area. The Chairman, in moving the adoption of the report, referred to the satisfactory progress of the Company as showing that the step the Directors had taken in encouraging the use of prepayment meters was in the right direction. They had 600 of these meters distributed over the district. With regard to the use of incandescent burners in the public lamps, it was found that, notwithstanding the great distance between the lamps, Redhill was more brilliantly lighted now than it was before. Passing on to refer to the growth of the Company since it was formed in 1860, he said they were at the limit of their manufacturing capacity, as they carbonized twice the bulk of coal now they did at the commencement. Extensions were necessary; and there had been a re-arrangement of the working staff. Mr. Read, who had been with them a quarter of a century, had been appointed Secretary, and would look after the accounts; while Mr. J. C. Belton, their new Engineer and Manager, who had come to them with great recommendations, would produce the article they had to sell. The report was adopted. A special meeting of the Company was held on the same evening at which the shareholders formally approved of the Bill now being promoted by the Company to sanction the acquisition of the undertaking of the Reigate Gas Company.

The half-yearly report of the Directors of the Rochester, Chatham, and Strood Gas Company shows a total income of £28,930 for the half year ending Dec. 31. The aggregate expenditure being £25,855, there is a net profit of £3075. The Directors have declared a dividend at the rate of 10 per cent. per annum on the "A" and "D" shares, and of 7 per cent. per annum on the "B" and "C" shares.

The half-yearly general meeting of the Scarborough Gas Company was held last Saturday, when the Directors presented accounts which showed a sum of £6748 available for distribution. The receipts in the six months ending Dec. 31 amounted to £22,448; the expenditure to £15,476—leaving a balance of £6972. The maximum dividends were recommended. These absorbed £5772, and left £976 to be carried forward. The demand for gas continues to increase. Under the supervision of Mr. J. Holliday, the Engineer and Secretary, 13,562 tons of coal and cannel were carbonized. The estimated quantities of residuals produced were: Coke, 8137 tons; tar, 789 tons; and ammoniacal liquor, 1276 tons. Extensions in the purifying department, as well as an installation of carburetted water-gas plant, have been decided upon, and will be carried out during the coming summer. The Chairman (Mr. B. Fowler, J.P.), in the course of his remarks when moving the adoption of the report,

mentioned that the Directors had decided, after consulting Mr. Corbet Woodall, M.Inst.C.E., to extend the purifying plant and put up a water-gas installation to supplement the existing supply. The report was adopted; and the dividends recommended were declared.

At the annual meeting of the South Shields Gas Company next Friday, the Directors will report that the revenue in the past year amounted to £63,411, and the expenditure to £45,879; leaving a balance of £17,532. The receipts from the sale of 362,042,000 cubic feet of gas for private consumption and 16,526,300 cubic feet for public lighting, produced £49,645; the sale of residuals yielding £9156. After paying the interim dividend, there is an available balance of £8831. The dividend for the second half of the year (making up 9¼ per cent.) will amount to £7871; so that there will be a balance of £960 to carry forward. The Directors report a marked increase in the sale of gas over the previous year—viz., 26,919,618 cubic feet, representing a gross money value of £3368 5s. 10d., or 6½ per cent. On the other hand, the profits from coke, tar, and ammonia were £2188 19s. 5d. less than in the previous twelve months; prices having ruled extremely low, especially for sulphate of ammonia. Much better returns are, however, now being obtainable from residuals. Under the supervision of Mr. W. J. Warner, the Company's Engineer and Manager, 47,066 tons 18 cwt. of ordinary coal and 1910 tons 5 cwt. of cannel were carbonized or used last year. The production of coke was 30,554 tons; of tar, 501,849½ gallons; and of liquor, 489,120 gallons, the whole of which was used in the manufacture of sulphate.

The profits of the Wakefield Gas Company for the half year ending Dec. 31 were £6888; and in their report the Directors recommend the payment of the usual dividends at the rates of 11½, 9, and 8½ per cent. per annum on the various classes of shares, all clear of income-tax. The total revenue in the six months amounted to £17,898, of which £14,016 was for gas supplied for private and public lighting; the expenditure was £12,253, of which £5276 was for coal. The balance carried to the profit and loss account was £5645. At the meeting of shareholders on Monday last week, the Chairman (Mr. W. A. Statter, J.P.), in going through the accounts, reminded the proprietors that the price of gas had been reduced during the half year to which they related from 2s. 8d. to 2s. 6d. per 1000 cubic feet, that premises within 25 yards of the nearest gas-main were connected free of expense; and that gas cookers and fires were also fixed free. He was glad to say gas was coming more into use every year for various purposes; and it was hoped the concessions the Company had made would still further promote its use. Though the winter had been very mild, they had been able to earn their dividend, which the Directors considered satisfactory, in view of the fact that several companies had had to fall back on their reserve funds. The report was adopted. An addition of £50 was made to the salary of the Secretary, who has been in the Company's service more than twenty years. A vote of thanks having been accorded to the Chairman for presiding, and to the Directors for their attention to the business of the Company, the Chairman, in responding, proposed the usual vote of thanks to the staff. This was duly acknowledged by the Engineer (Mr. H. Townsend, Assoc.M.Inst.C.E.) and the Secretary (Mr. W. H. Parker); and the meeting closed.

The revenue of the Waltham Abbey and Cheshunt Gas Company for the six months ending Dec. 31 was £4400; the expenditure, £2924. A sum of £200 has been placed to the suspense account; and the balance carried to the profit and loss account is £1275, as compared with £1031 for the second half of 1896. A sum of £1991 is available for distribution; and at the meeting of the Company on the 25th inst. the Directors will recommend the declaration of dividends at the rate of 7 per cent. per annum on the "A" shares, and of 5 per cent. per annum on the "B" and "C" shares; leaving £904 to be carried forward. The quantity of gas sold to private consumers was 15,627,700 cubic feet; for public lighting, &c., 2,291,600 cubic feet. Apart from a slack demand for coke and the low prices prevailing for other residual products, the past half year was a prosperous one; the gross revenue showing an increase of £498. Before the close of the period reported upon the new gas-holder, with a storage capacity of nearly 300,000 cubic feet, was completed under the superintendence of the Company's Manager (Mr. W. Bince Randall), and brought into use with beneficial results.

At the meeting of the Wellingborough Gas Company, Limited, next Monday, the Directors will submit to the shareholders a statement of accounts showing favourable results for the half year ending Dec. 31. Notwithstanding the exceptionally mild season, the quantity of gas sold was about 8¾ per cent. more than in the corresponding half of the previous year. The sale of 37,900,200 cubic feet for private consumption, and 2,302,200 cubic feet for public lighting, produced £5661; and the total revenue was £6874. The expenditure amounted to £4728; so that there was a balance of £2153 to be carried to the profit and loss account. The amount available for distribution is £2838; and the Directors recommend the usual dividends of 5½ and 4 per cent. for the half year, free of income-tax. The Company's charge is now 3s. per 1000 cubic feet, less 2d. discount for cash; 10 per cent. being taken off for gas used for motive power. Under the supervision of the Engineer and Manager (Mr. J. T. Lewis), 3858 tons of coal were carbonized in the half year. The bulk of gas made was 41,890,000 cubic feet, of which 40,202,400 cubic feet were sold and 40,510,100 cubic feet were accounted for; being at the rate of 10,858, 10,420, and 10,500 cubic feet per ton respectively. The unaccounted-for gas is only 3·29 per cent. With regard to residuals, every ton of coal carbonized yielded 9 cwt. 2 qrs. 13 lbs. of coke for sale; 46,249 gallons of tar and 52,000 gallons of liquor were produced, and 15 tons of sulphate of ammonia made. The amount of capital expended on the works at the close of the year was £42,086; being at the rate of £5 17s. 4d. per ton of coal carbonized for the twelve months.

At the meeting of the Wolverhampton Gas Company to-day, the Directors will present accounts showing a net profit of £8104 for the six months ended Dec. 31. This added to the balance brought forward, makes a total of £10,830, out of which the Directors recommend the payment of dividends of 3 per cent. upon the preference stock, £5 5s. per cent. upon the consolidated stock, and £3 5s. per cent. upon the new ordinary stock, less income-tax. This will leave a balance of £3421, out of which the Directors suggest that £323 should be placed to the reserve fund, making, with the sum to be paid in respect of dividends on the consolidated and new stocks, a sum equal to the statutory dividends permitted at the Company's current price of gas. They further recommend the placing of £500 to the insurance fund. In their last report, the Directors informed the proprietors that extensive additions to the manufacturing plant at the Stafford Road works were under consideration. These are now being carried out; and the whole of the plant required, including preparations for future extensions, will be erected during the present year.

Water Companies.

The half-yearly meeting of the Colne Valley Water Company was held last Tuesday, when, in the absence of Mr. J. R. Holland, the Vice-Chairman (Mr. C. E. Keyser) presided. In moving the adoption of the report and accounts, he called attention to their satisfactory character. The water-rates for the half year amounted to £9388, as against £8477 in the corresponding period of 1896, which was an increase of £911. In the midsummer half of last year, the increase, compared with the first six months of 1896, was £322; so that the total advance for 1897 was £1233. This was the largest increase the Company had ever had in one year, with the exception of that in which the Harrow and Wembley districts were acquired. The number of new supplies in the past half year was 214, representing £461 a year; and in the first half there were 185 new supplies, representing £473. This gave them a total of 399 new supplies for the year; being equivalent to an additional income of £934. This was more satisfactory than in any previous year, as it was about 25 per cent. above the average. The total number of supplies was now above 8000; and the population supplied, about 46,000. When they started the undertaking, they only supplied Bushey and Stanmore; and therefore from small beginnings, they had grown until now they served a large and populous district. It was natural, with the increase in their business, that the expenditure should be more. There had been some addition to the fuel account; and the item of rates and taxes was larger owing to an increase in the assessments, and to the high rates in several of the parishes—especially in Bushey and Wembley, where they were 9s. 2d. and 8s. respectively. The main portion of the Company's works being in the former parish, the high rates affected them considerably. The total quantity of water pumped in the half year was 260 million gallons; being an average of 1,413,000 per day. In the corresponding half year, the average was 1,200,000. This was a marked increase; and it was out of all proportion to the advance in the number of consumers—probably owing to the dry weather. With regard to the dividend, in February of last year the Directors recommended an increase of ½ per cent., making a distribution at the rate of 4½ per cent.; and now they were able to propose a further ½ per cent, notwithstanding the issue of an additional £12,000 of capital in the meantime. He proceeded to refer to the satisfactory working of the new engine which had been put down; and to the gratifying result of an analysis of the water by Professor J. and Dr. H. Attfield, with whom arrangements had been made for periodical reports. Mr. A. Helsman-Jones seconded the motion, which was unanimously carried. The dividend recommended was passed; and the retiring Directors (Lord Aldenham and Messrs. Part and Pitcairn) and Auditor (Mr. B. D. Kershaw) were re-elected.

At the annual meeting of the Newcastle and Gateshead Water Company to-day, the Directors will present accounts showing that the revenue in the year ending Dec. 31 last was £127,829, as compared with £120,518 in the preceding year; and that the expenditure was £31,252, as against £31,093. The amount transferred to the dividend and interest account is £96,677; whereas this time last year it was £89,425. There is a sum of £43,926 available for distribution; and the Directors recommend the payment of the usual dividend upon the preference stock, and dividends at the rates of £8 10s. and £5 19s. per cent. per annum on the two classes of ordinary stock—making with the interim dividends £7 15s. and £5 8s. 6d. per cent. for the year. After payment of these, there will be £2777 to be carried forward. The new filter-beds at Whittle Dian are ready for use. A total of 26,973 yards, or 15 miles, of pipes were laid during the year.

At the meeting of the Sunderland and South Shields Water Company next Thursday, the Directors will present accounts showing that the water-rents in the past year amounted to £75,085. The expenditure having been £40,312, there was a balance of £34,773 to go to the profit and loss account. The amount available for distribution is £46,822; and the Directors recommend a dividend for the half year ending Dec. 31, at the rate of 4½ per cent. on the ordinary and preference stocks, and of £3 3s. per cent. on the additional capital stock; making with the interim dividend 9 per cent. on the former, and £6 6s. per cent. on the latter for the year, free of income-tax.

SALE OF GAS AND WATER STOCKS AND SHARES.

At the Mart, Tokenhouse Yard, on Monday last week, Mr. Alfred Richards conducted a sale of debenture and ordinary stocks and shares in gas and water undertakings. It opened with the offer of a new issue, by order of the Directors, of £3500 of ordinary 5 per cent. stock of the Crays Gas Company, which was sold at an average of £121 11s. 5d. per £100; yielding the purchaser £4 2s. 3d. per cent. Some £10 fully-paid "B" (7 per cent.) shares in the Maidenhead Gas Company were then offered; and they were bought for £17 2s. 6d. each—returning £4 1s. 8d. per cent. A new issue, by order of the Directors, of £2500 of 4 per cent. perpetual debenture stock of the Great Yarmouth Water Company, was next submitted, and was sold at an average of £121 11s. 2d. per £100; returning the purchaser £3 5s. 9d. per cent. Some new ordinary £10 fully-paid shares in the same Company were then put up, by order of a shareholder; and they changed hands at an average of £13 5s. 8d. each, yielding £3 0s. 2d. per cent. A parcel of fully-paid £5 shares in the Henfield (Sussex) Gas Company, on which the dividend is 2½ per cent., realized £2 10s. apiece; returning the purchaser 5 per cent. The next lots consisted of a new issue, by order of the Directors, of 170 £10 shares in the Whitchurch (Hants) and District Gas Company, carrying a dividend of 6 per cent.; and they were purchased at an average of £12 18s. 6d. per share, yielding £4 12s. 10d. per cent. A few fully-paid £5 shares in the Goring and Streatley District Gas and Water Company were next sold at £2 12s. 6d. each. Four fully-paid £50 "B" shares in the Portsea Island Gas Company, the last dividend on which was at the rate of 13 per cent. per annum, changed hands at £154 apiece—returning the purchaser £4 4s. 5d. per cent.; three "C" shares, of the same nominal value, on which 12 per cent. was the last dividend paid, being sold for £147 each—the buyer getting £4 1s. 8d. per cent. on his investment.

BAKEWELL GAS-WORKS PURCHASE ARBITRATION.

Royal Courts of Justice.—Saturday, Feb. 12.

(*Before Mr.* C. A. Cripps, Q.C., M.P., *Umpire.*)

The arbitration to fix the price to be paid by the Bakewell Urban District Council for the undertaking of the Bakewell Gas Company was commenced to-day.

Mr. E. H. Stevenson, M.Inst.C.E., was Arbitrator for the Company; while Mr. T. Newbigging, M.Inst.C.E., acted in a similar capacity for the District Council. Mr. A. J. Ram appeared for the Company; and Mr. W. B. Hextall for the Council.

Mr. Ram, in opening the proceedings, said his remarks would be very few as the case seemed a very simple and straightforward one. The figures had all been agreed; and if he was right in his view of the case, the only peculiarity about it was the agreement for arbitration, which would require a little explanation. Under the agreement of Nov. 17, 1897, the District Council had to buy the undertaking.

The Umpire remarked that he had no knowledge of the agreement.

Mr. Ram said he would hand in a copy. An agreement had been arrived at by which the Council agreed to buy the undertaking, leaving the figure to be fixed by arbitration. There was one other matter, in addition to the figure, which was within the purview of the Arbitrators. The Company was a non-statutory one, and had been in existence for a great many years; having been established by Deed of Settlement in the year 1848. There was a Certificate of Incorporation under the Joint-Stock Companies Act in 1857. The peculiarity about the Company was the extraordinarily large proportion of the present value of the undertaking as contrasted with the original capital. The capital was £1500; but the present value, as he should contend, was about £9000. The value as shown by the admitted tables was nearly £6000. The difference between the two was accounted for in this way: Whereas the Accountant could only, from the accounts, arrive at a certain proportion of the amount of money spent on capital account, Mr. Chester represented that there was a value much larger than that which could be traced through the accounts; and it would be for the Arbitrators to decide between the figure of £5000 odd and £9000. Apart from the £1500, the only sum which might be properly called capital was a loan of £400 which was issued in January, 1893, and repaid out of income between that date and the present time. The Company had been a very flourishing one from its inception; having since 1866 paid a dividend of 10 per cent., and sums in arrear on account of former dividends. As there were no further arrears to be paid, it might be taken to be a Company, which, during all its existence, had paid 10 per cent. on its capital.

The Umpire asked whether there was any limitation as to dividend.

Mr. Ram replied that there was not; but when there was anything over 10 per cent., it had been spent on improvements. At the commencement of the undertaking, the price of gas was 8s. 4d. per 1000 cubic feet. From 1887, it had been 3s. 4d. per 1000 cubic feet; and since 1891, gas had been supplied for cooking purposes at 2s. 6d. per 1000 cubic feet. The maximum daily output in 1897 was 45,753 cubic feet. In 1888, the sale of gas was something under 6,000,000 cubic feet; and in 1897, it had gone up to 8,620,900 feet. The profits for the year ending June 30, 1897, were £553 11s. 1d. There were no large consumers in the district supplied by the Company; and therefore it was certain that the demand in future would be what it had been in the past, *plus* what he was now going to call attention to. Practically the whole of the property belonged to the Duke of Rutland; and in the past the policy had been not to let land for building purposes. But this system had now been changed; the present Duke being not only willing to give facilities for building, but to sell land. In the future, therefore, there would be no hindrance to building. This was a material consideration in judging the value of the property. The works had been well conducted; there having been practically no complaints. The leakage was small; being 12·47 per cent. With regard to the expenditure, he could not give the different items of carbonizing, purification, and repairs and maintenance, as in a small works it was not possible to disintegrate all the items; but the amount, lumped together, for 1897 was 9·02d. per 1000 cubic feet of gas sold. Having now indicated the nature of the undertaking, he thought he was justified in saying it was a very flourishing one; and if ever there was a non-statutory Company which ought to receive a high price for their works, this was that one. Now a word or two as to the history of the Company. The buildings and plant were originally erected on land which was the property of the Duke of Rutland, there being no agreement or lease; but afterwards a lease for 54 years was granted, of which 15 years had still to run. There was a small portion of freehold land belonging to the Company on which part of the works were erected; but the Arbitrators would not be troubled with this, as, according to the agreement, the whole of the land was to be treated as freehold. In 1895, the Company (wishing to obtain some security in the event of extending their works) approached the Duke, who refused to sell them land unless the Urban District Council declined to purchase the undertaking. The feeling of the Duke was that the works ought to be in the hands of the Local Authority; and therefore he said: "If the Local Authority are willing to buy, I will sell to them; if they will not purchase, I will sell to the Company." The Company asked not to be left to the tender mercies of the Council; and the Duke then promised not to sell to them unless he saw they were disposed to treat the Company properly. The result was a tripartite agreement between the Company, the Duke, and the Council, under which the present arbitration was proceeding.

The Umpire asked whether there was any question that the property was to be taken on the basis of a freehold.

Mr. Hextall said none at all.

Mr. Ram stated that it was agreed the price to be paid should include the sum of £1200 which was to be handed over to the Duke for the land. As the Company had no wish to sell, they asked for 10 per cent. for compulsory purchase. All they wanted was to obtain security from the Duke to enable them to carry on the works; and then there was put on them what might be termed a "squeeze" by the Duke.

Mr. Hextall said he should submit, as a matter of law, that this being an arbitration under an agreement, the Arbitrators could not go into the question of how the agreement was brought about.

The Umpire thought there was no objection to Mr. Ram historically opening his case.

Mr. Ram said he proposed to read the correspondence which had passed between the Solicitors of the Gas Company and the Agent of the Duke of Rutland.

Mr. Hextall did not object to his learned friend stating that the sale was compulsory; but he did object to admitting the correspondence.

Mr. Ram said he would not read the correspondence if his friend would admit that the result was this—that the Company said they did not wish to sell, and they were only selling because they could not get any security from the Duke.

The Umpire: Would you claim 10 per cent. if you were compelled to sell owing to the Duke's attitude?

Mr. Ram said he should contend that 10 per cent. was not a penalty to the person who put the squeeze on the Company. If the Council had approached Parliament for power to purchase, the Company could have claimed the 10 per cent.

The Umpire said he considered they had a free hand upon this point.

Mr. Ram remarked that that being so, he would not pursue it.

The Umpire: Suppose I accept it from you that there was a squeeze, and that it came from the Duke, then we know the circumstances.

Mr. Hextall said the Duke was squeezing them together. He did not admit that there was any more squeeze on the part of the Duke towards the Company than there was towards the Council.

The Umpire: Then there was a double squeeze.

Mr. Stevenson: Perhaps that would make it 20 per cent.

The following evidence was then given on behalf of the Company.

Dr. *John Knox* said he was Chairman of the Company, having been a Director since 1882. The history of the Company as described in the opening was perfectly correct. The undertaking had been a prosperous one since he had been connected with it. There had been practically no complaints as to the way in which customers were treated. He recollected only one as to insufficient supply; and this was at once remedied. As the town was steadily increasing, there could not but be an increase in the quantity of gas consumed. In the event of the undertaking being taken over, there were two old servants for whom some provision ought to be made.

Cross-examined: There had been verbal complaints from customers, but nothing of any importance; they would not amount to more than half-a-dozen altogether. The plant was not up to date. There had been an extension in the area of Bakewell since 1891; and an increase of 400 to 500 in population. In 1891, the population was 2748.

Mr. *Hall*, of Matlock, was next called to prove the accuracy of the accounts which had been handed in. He said the figures had all been agreed with a representative of Mr. Lass.

Mr. *W. R. Chester*, M.Inst.C.E., said he had inspected the gas-works, and was generally acquainted with the district supplied. The works were constructed on a very suitable site on the outskirts of the town, having a frontage to the river and the road, with a down-gradient from the railway station, so that coal could be got in cheaply and quickly. Bakewell depended in part for its prosperity on summer visitors; and therefore it was desirable that the gas-works should be out of the town. The daily output of gas was 45,753 cubic feet; and the buildings were substantial, and in good condition. The apparatus was also in a good state, and adequate to the present output. A portion of the apparatus was new within quite recent years. The retorts, condensers, scrubbers, and washers were new. One of the gasholders was new, and another was ten years old. On the whole, the works were substantial, well built, and equal to the present output. A considerable increase in consumption could be obtained, without extending the works beyond their present area, by simply bringing up the retorts to modern practice of construction. Although the retorts were new, they were not on the best working system for results.

The Umpire: You are not claiming prospective value?

Mr. Ram: No.

The Umpire: You wish to show that the value as fixed on June 30, 1897, is secure?

Mr. Ram: Quite so.

Examination continued: By telescoping one of the gasholders and modernizing the retorts, the output could be greatly increased. The present figure was well secured. The distributing plant was in very fair condition. The leakage was only a moderate one; being 12·47 per cent. In small undertakings of this kind, the leakage was higher than was usually the case in large works, because the output being small a minute quantity percolating through any orifice in the pipes soon amounted to a large percentage on the consumption. In the adjoining town of Matlock-Bath, the leakage was 16·48 per cent., and in Swadlincote, 20 per cent.

Mr. Stevenson: Swadlincote could hardly be compared with Bakewell.

Examination resumed: He had no doubt that the present profits would be more than maintained. The district was practically an undeveloped one. The Company had done nothing to stimulate the consumption, owing to a certain feeling of insecurity of tenure. Whatever was to be gained by pushing, was open to those who had the works in the future. There was a large field for increasing profits by means of prepayment meters and the hire of gas-stoves for cooking. There were no large consumers; and the consumption of gas was fairly distributed over the town. This was an increased security for maintaining the profits. The price charged for gas—viz., 3s. 4d. and 2s. 6d. per 1000 cubic feet—was exceptionally low for a town of this size. The agreed profit for 1897 was £553 11s. 1d.; and taking the multiplier at 24 years, it gave £13,333 6s. From this had to be deducted the £1200 to be paid to the Duke; leaving a sum of £12,133 6s. As the Company were now, and always had been, unwilling to part with the undertaking, he added 10 per cent. for compulsory sale.

Cross-examined: There was a crack in the side wall of the retort-house, which was due to a new piece having been added to the old wall. This was of no consequence. The wall was not 5 or 6 inches out of plumb. He had visited the works twice. There was nothing to complain of about the roof of the retort-house; it was very good, and satisfactory for the purpose. The crack in the wall would not be caused by the heat of the retort-benches. To increase the quantity of gas made, the retorts would require re-setting; but this would be a small matter.

By Mr. Stevenson: No re-arrangement of the retort-house would be necessary; the same building would contain the modern retorts.

By Mr. NEWBIGGING: He would put in larger retorts, and more in an oven.

Cross-examination continued: There would be no difficulty in doing this. One of the gasholders was about 50 years old. When the District Council took possession, they could use this for a tank if they liked. At present, it was sufficient for the purpose. The aggregate capacity of the holders was 50,000 cubic feet.

By Mr. STEVENSON: The capacity of the small holder was 6000 cubic feet. Even if it were thrown out of use, the storage was sufficient.

Cross-examination continued: The small holder was in use when he visited the works. There might be a leak here and there; but he had regarded it from the point of antiquity. No. 2 holder contained 9000 cubic feet. He could not say whether it was capable of being worked to its full capacity; but he knew of nothing to the contrary. He had not been told that the centre girder of the holder failed at times. No. 3 was a new holder, and was in an excellent state of preservation. The purifiers did not appear to be abnormally shallow. No. 4 holder was a new one. The scrubber had been newly painted. The washers were in full operation, and worked very well. He did not know whether there were bye-passes to the washers. The 3-inch main was laid at a depth of 15 inches. It would be difficult to lay it at a greater depth, as the area was rock, and the cost of excavation would be heavy. The main that he saw opened was on very hard ground. A depth of 15 inches, when the base was firm, was quite sufficient. The total length of mains was 7100 yards; and the size ranged from 1½ to 6 inches. In the Swadlincote case, he stated that mains of less than 3 inches ought not to be encouraged; but this remark did not apply here, as the foundation was different. The absence of complaints indicated that there was nothing absolutely wrong with the mains. Of the 9d. for carbonizing, purification, and wear and tear of works and mains, 5d. per 1000 cubic feet would be ample for the repair of works and mains.

Mr. NEWBIGGING: On the question of leakage, I notice the consumption of gas at the works has suddenly risen from 1⅓ to 2½ per cent. Is there any reason for this?

Witness: It arises from erecting a gas-engine to drive the exhauster.

Was this engine not working in 1895?—I really could not tell. Probably it is not in as good a condition as it was then.

That is a very large percentage to be used on the works?—It is much higher than on larger works; but I do not think it is excessive, having regard to the fact that the exhauster engine is driven by gas.

You would not compare this district with Swadlincote, which is undermined?—No; the ground is bad there. The leakage there was about 20 per cent. It had been as high as 30 per cent.

Now as to the size of the mains. Leaving out of question the 1-inch and 1½-inch mains, is not the proportion of 2-inch mains very large?—It is not quite one-half.

Do you agree that 2-inch mains should be used at all?—Not if they were laying them to-day; but in years gone by 2-inch mains were very common. I should not lay a 2-inch main now.

Would you advise that the whole of the mains should be taken out and replaced by larger ones?—No; only such as were necessary, and were called for by the consumption of gas. A 2-inch main is quite adequate for the supply required.

Mr. STEVENSON: Suppose the gasholders and mains were made tight, and the leakage reduced very considerably, would not the amount of money spent in doing this be repaid by the saving of gas lost, and so increase the profits in a very short period?

Witness: Yes. We do not ask them to pay for anything we have not earned, but only for the profits which are actually made under the condition in which the works are.

If the works were put in absolute order, you would have made a claim for increased profit?—Yes, for the increased profit arising from the improvements.

The UMPIRE: Would you lay that down as a general proposition, or must you consider the circumstances in each case?

Witness: You must consider the circumstances in each case.

Mr. RAM intimated that this was the case on behalf of the Company.

The UMPIRE suggested that Mr. Hextall should defer making any speech until he had called his evidence.

Mr. *Benjamin Morton*, a member of the Bakewell Urban District Council, and Chairman of the Lighting Committee, said he carried on business in Manchester as a Contractor. He had known Bakewell thoroughly for the last three or four years, and had given particular attention to the gas-mains. He entirely disagreed with the evidence given by Mr. Chester with regard to them. He then went through a great number of the mains in detail, and complained of them all being laid an insufficient depth (ranging from 9 to 12 or 14 inches) and having turned and bored joints; and there being a deal of heavy traffic, constant leakages ensued. He considered the condition of the mains generally was bad. Various lengths of main had been laid open for examination. In most cases they were in good condition; but being too near the surface, they had been displaced sideways, and the joints suffered. In one place, a 2-inch main ran some distance absolutely on the surface; and in another only 4 inches below it. For nearly a mile on the Haddon Road the main did not belong to the Gas Company at all, but was put in by a private gentleman. In the Square there was an old 4-inch main, which originally led from the gas-works into Bakewell, and 25 or 30 years ago, being found insufficient, was taken up and relaid in the Square. This main was absolutely rotten, and crushed in when an attempt was made to drill it. At the bottom of Station Hill, there was a fairly good 2-inch main; but it was only 8 inches below the surface, and had recently been crushed by the passage of a traction engine. In another place, the main had recently been broken by a steam-roller; and since the discovery that these mains were so near to the surface, the District Council had had to abandon any idea of rolling the roads this year. A large portion of the main on the Haddon Road was in private ground, the owner of which could take it up whenever he thought fit. That part of the public road was without any street-lamps. There were no proper syphons on the whole system; but there were some dip-pipes. He had heard constant complaints about the gas supply, and had fault to find with his own supply, but had not made any complaint personally to the Company. If he had anything to do, he was obliged to use a lamp or a candle. His house was on a main road; and he recently went to the expense of putting a new main through his garden up to the house. This, however, had not improved the supply.

In reply to Mr. NEWBIGGING, witness said he did not think there was a deficiency of pressure; but he could not say for certain, as he had no means of testing it. The lights seemed to burn languid; there was no lighting power in the gas at all.

By Mr. HEXTALL: He thought the poor light was owing to want of pressure, and bad quality.

Mr. STEVENSON: If you had better pressure, you would burn more gas, would you not?

Witness: Perhaps so; but I should regulate it. I should not object to that, if I obtained a good light.

By Mr. HEXTALL: He thought it was attributable to the main being silted up inside.

The UMPIRE asked if there were any actual tests of the illuminating power of the gas.

Mr. HEXTALL said there were none.

Mr. RAM intimated that he could prove the Company used about 20 per cent. of cannel, which he was instructed would give about 19-candle gas. In the Act, they were limited to 15-candle power.

Witness (continuing his evidence) said that the main supplying his house was a 2-inch one, 893 yards in length. Coming to the state of the works, the side of the retort-house next to the road was 5 inches out of plumb; and there were large cracks in it. The arches over the retorts were all giving way; and he thought they were ready to collapse. They would certainly want to be replaced next summer, or they could not be used at all the following winter.

By Mr. STEVENSON: That would be ordinary wear and tear.

Examination continued: The old holder was completely done for; it having been patched and painted with a view to holding gas. When he inspected it, it had about 2 feet of gas in it; and it would not hold much more. With regard to the other two holders, he was of opinion that they would not contain water to the top of the well. No. 4 was a new holder. The gas-engine, exhauster, meter, and No. 4 holder were the only four things worth having. The scrubber was not at work, and had not been for some time. He inspected the mains at about twenty points in different parts of the town, and found in some instances small pipes supplied larger ones. There was a total absence of system; the whole thing had been patched up with a view to saving expense. To put the entire system of mains into proper workable repair would cost £857 15s.

By Mr. STEVENSON: He was not a gas engineer, and had not calculated what the saving in leakage would be.

Cross-examined: He was a joiner by trade; and he ultimately developed into a contractor. He had never complained about the insufficiency of supply.

Mr. *William Redfearn*, Surveyor to the District Council, was called to prove that the mains were not laid at a sufficient depth. According to witness, the depth varied from 4 to 14 inches. At one time he was employed by the Gas Company as collector; and while so engaged, he received many complaints of insufficient supply. These complaints were always entered in the meter-book; and in some instances the Secretary was informed of them. Witness mentioned the names of several persons who made complaints. On one occasion, a service-pipe was broken by a traction engine passing along the road; and on another, the steam-roller broke a main which was 12 inches below the surface. The use of the steam-roller had now been suspended. Many of the pipes were laid on the top of the rock. He had opened the ground at 150 places to examine the pipes, and found the connections had been done in the cheapest possible way. He agreed with the evidence of Mr. Morton, as to the connections and the state of the retort-house and plant.

Mr. *G. H. Taylor Whitehead*, J.P., Chairman of the Urban District Council, said that since 1895 he had resided at Burton Closes. The quality of the gas was very bad, compared with that of The Gaslight and Coke Company. It was yellow and flickering; and there was not enough pressure. It was so bad in his billiard-room, that he had been obliged to put in incandescent lights; and even now it was not satisfactory. When the shops were closed, there was a manifest improvement. He was a large consumer of gas.

By Mr. STEVENSON: With a greater pressure, he would burn more gas. He thought 3s. 4d. per 1000 cubic feet was a high price, considering they were near the Chesterfield coal-fields.

Examination continued: There had not been any great increase in the number of houses in Bakewell. He thought it very unlikely that Bakewell would ever become a favourite tourist resort, considering it was half-way between Buxton and Matlock.

Cross-examined: When the Council took over the works, they hoped to remedy all the defects which had been pointed out. If they had to make an outlay on plant, they would expect to sell more gas, although he did not think there was much chance of development. He supposed the same amount of leakage would continue. He could not say whether, when the Council had the works, the price of gas would be reduced.

The UMPIRE said that what was done by the District Council afterwards could not affect the present price of the undertaking.

Re-examined: The general opinion in Bakewell was that the gas supply was bad.

Stephen Haslam, a labourer in the employ of the Gas Company, said he had laid most of the mains. In his opinion, the trunk main was in good condition; but the other parts were in a very bad state. Some of the pipes which he laid by contract were at a depth of 15 inches, and rested on the solid rock. He had known of sixteen escapes within a distance of 50 yards; and in many cases, the mains had been broken by the traffic. About two-thirds of the mains wanted relaying, as they were too shallow—only 4 to 9 inches below the surface.

Cross-examined: Some of the trunk pipes had been down from 25 to 30 years; but he only recollected two troubles in connection with them. The reason for the other pipes being so shallow, was that they were laid on the rock.

The further hearing was then adjourned.

Further Borrowing Powers for Sowerby Bridge.—The Gas Committee of the Sowerby Bridge District Council have decided to make application to the Local Government Board for further borrowing powers to the extent of £4000 or £5000. The step has been rendered necessary on account of money having been taken out of revenue for extensions of works and the purchase of gas-stoves.

WALSALL CORPORATION GAS ACCOUNTS.

Reduced Profits.

At the Quarterly Meeting of the Walsall Town Council, the Gas Committee reported that the net profit for the past year was only £4519; being £3019 less than in the previous year, although the amount received for gas sold was £2440 more. The reduction in the profit was mainly due to increased expenditure under the following heads—viz., Weekly wages, £1224; coal, £1058; repairs and renewals, £658; rates and taxes, £654; and allowances for discount, &c., £408; while the loss on the sale of coke and other residuals was £977—representing in the aggregate above £5000. The reduced profit would necessitate the taking from the reserve fund of £981, as the profit had fallen short by that amount of the sum which was carried to the borough fund during last year in relief of the borough rate. The Committee had considered a letter from the War Office as to the employment of army reserve men, and had authorized the Manager to employ such men where practicable. Mr. T. P. Brownhill, in reviewing the causes of the reduced profits, stated that the Committee had been reducing the price of gas until now it stood at 2s. 6d. per 1000 cubic feet, with 5 per cent. discount, bringing it down to 2s. 4½d.; and in addition they provided meters free of cost, which brought the price to 2s. 2½d. This would compare very favourably with any other town in the Midlands. They had also reduced the price for the public lamps from £2 7s. 6d. to £2 5s. But the most serious loss was with regard to the residuals. During the last twenty years, the gas undertaking had contributed in aid of the rates £120,000; £16,000 of this being in the last three years. In addition, they had raised the reserve fund in the latter period from £3000 to £14,000; and the interest upon this would materially help them in times like the present. Looking at the matter all round, there was not much cause for regret. The report was adopted.

THE DAWSHOLM GAS-WORKS.

Lecture by Mr. A. Wilson.

Last Thursday night a lecture on the Dawsholm Gas-Works was delivered to the Glasgow University Engineering Society, by Mr. Alex. Wilson, the Manager of the works. The chair was occupied by the President (Mr. H. C. Sadler, B.Sc.), who briefly introduced the lecturer.

Mr. Wilson said that it was now fully a hundred years since a member of a Parliamentary Committee said to Murdoch, the inventor of gas lighting: "Do you mean to tell us that it will be possible to have a light without a wick?" "Yes, indeed I do;" was the answer. "Ah, my friend, you are trying to prove too much," said the member. But William Murdoch was able to prove that he could indeed give a "light without a wick," and show himself to be the founder of a most useful and important industry, which had done so much for the comfort of the people generally, and had aided in many ways the success and formation of other industries. In order to enable his audience to understand how that "light without a wick" was produced, the lecturer said he would endeavour to give them some insight into the plant used in a gas-works.

That wonderful substance which they knew as coal was, according to geologists, of vegetable origin, having been brought to its present condition by the protracted influence of heat, pressure, and moisture. It varied very much in its composition and character. The most distinctive classes were lignite or brown coal, cannel coal, bituminous coal, and—last of the series—anthracite, with ever so many grades between the several classes. The most valuable for gas-making purposes was cannel coal; but as the supply of that quality was not equal to the demand, many others had to be used. In selecting coal for gas manufacture, many different points of value had to be carefully considered—price, the quantity and quality of the gas and coke produced, and the yield of tar and ammonia. The amounts of the different impurities in the coal had also to be noted.

When coal was burned in any ordinary fire, the gaseous products were disengaged; but they were only partially consumed—a great quantity passing away as smoke, while the solid residue (which was mainly carbon) was slowly consumed by the aid of the oxygen of the air passing through the fire. To enable gas makers to retain the volatile products of the coal without loss, they had to resort to what chemists termed destructive distillation in closed vessels called retorts, which were externally heated to a suitable temperature. In these the coal was placed, the door or lid being tightly closed, and the coal carbonized—that was to say, the gaseous and liquid constituents of the coal were driven off, but kept from contact with the air, and only the carbon or coke was left behind. Mr. Wilson then proceeded to follow the coal from the time it entered the works by rail or canal, through the different apparatus, until it left as gas, coke, or other products.

By reference to a ground plan of the Dawsholm works projected on a screen, it was shown that there are connections by rail with both the North British and the Caledonian systems; and by these Companies the bulk of the materials are delivered. The Forth and Clyde Canal lies between the Dawsholm and Temple works; so that the coal, &c., delivered by the Caledonian Company has to be taken to Dawsholm by the tunnel which passes under the canal and connects the two works. The coal brought by the canal is unloaded by a steam-crane with tipping-buckets into railway waggons on the Gas Commissioners' sidings. Mr. Wilson explained that when the waggons with coal were in the sidings their contents were in the first place put into "lifts"—that was to say, the waggons containing the different classes of coal were so arranged that, as they were emptied in rotation, they would give the blend or mixture most suitable for making the quality of gas required. They were then taken by one of the locomotives used on the works, of which there were four, and run slowly over one of the weighbridges. A careful record was taken of the weight, number of waggon, and class of coal; and the particular retort-house into which the coal was sent would also be noted.

When the waggons are taken into the retort-house, they are placed over storage hoppers, into which they are unloaded. There are twelve hoppers, each capable of holding about 100 tons. From the hopper the coal falls, as required, by a shoot into the coal-breakers, which are strongly-built machines, having each two pairs of steel rolls driven by steel gearing direct from the crank-shaft of a horizontal high-pressure steam-engine. The top, and larger, pair of rolls have hooked claws or teeth, which draw in and crush the largest pieces of cannel or shale; and the bottom pair of rolls are fluted, and have rows of steel studs fixed on them, between which the coal is broken to the proper size for being carbonized. There are also twelve breakers, each capable of dealing with from 10 to 15 tons per hour. As the coal passes through the breaker, it falls into the hoist of an elevator (driven from the same engine as the breaker by chain belting), by which it is raised to the broken-coal hoppers, and stored ready for the charging-machines.

Before the stoking machinery was described, a look was taken at a cross-section of the retort-house. The lecturer explained that the retorts were built into arches or ovens in sets of eight, and set back to back; and he proceeded to point out that the retorts were heated by gaseous firing, which was a great improvement on the old method of direct firing, in which there was an ordinary grate, similar to a boiler furnace, placed directly among the retorts. With that style of furnace, the fuel had to be put in at short intervals; and when the depth of fuel on the grate was at its maximum, the quantity of air passing through the fuel was not sufficient to burn the gases given off, and so wasted the fuel, while when this burned low too much air passed in, and cooled the retorts. With gaseous firing, the gas-producers were filled with hot coke direct from the retorts, and just sufficient air was permitted to pass through the fuel to convert the carbon of the coke into the necessary quantity of carbonic oxide gas. This gas was conducted among the retorts, where it met with a secondary supply of air regulated so that it was just sufficient to convert the carbonic oxide into carbonic acid. The secondary air was raised to a high temperature before it combined with the gas from the producers by means of regenerators, which were flues so arranged that the air on its way into the oven had to pass between two sets of flues carrying away the waste heat from the oven to the chimney. A large portion of the waste heat was thus returned to the oven; and the initial temperature of the flame was greatly increased. A small jet of steam was admitted under the producers to rot the clinker, and make it easier to break up; while the steam, in passing through the hot fuel, was broken up into its constituents oxygen and hydrogen. The former combined with the carbon, and the latter helped to increase the fuel gas.

At this stage Mr. Wilson showed on the screen the old style of hand stoking, and described how the coke was conveyed into the yard.

In dealing with mechanical stoking, Mr. Wilson said the first consideration was to raise steam cheaply, in order to produce the power required. The boilers chiefly used in the works were of the Babcock and Wilcox pattern, of which there were four of 110, and three of 130 horse power each. They had a large amount of heating surface; and raised steam quickly. They were all fitted with close-barred grates and forced draught, so that coke breeze might be used as fuel. Breeze, which at one time could scarcely be got rid of, was now for a great part of the year the only fuel employed to generate steam. A considerable saving in the cost of fuel was thus effected. He next described the hydraulic pumping-engines, the working of the accumulator, and the distribution of the flexible hose-pipes through the retort-house, and explained their connection with the stoking-machines. He said there were several hose-pipes in the length of the house, each having a stopcock with a nozzle which fitted into a swivel joint on the machines. There was also a return system of pipes for conveying the water back to the pumps after it had been used. The lecturer remarked that the machine now employed for charging the retorts looked rather complicated at first; but all the parts were necessary for the work to be done. The hopper must carry sufficient coal—from 6 to 8 tons—for an hour's work or "draw." Then the coal had to be put into the retorts set at different levels, and distributed along the retort-house. Furthermore, the coal for each charge had to be measured, and deposited evenly over the bottom of each retort. Mr. Wilson described in detail the charging-machine, and showed how carefully and thoroughly it did its work. These machines had, he said, caused quite a revolution in retort-house work; materially reducing its cost, and lightening the labour of the stokers. The machines were the joint production of the Gas Engineer to the Corporation (Mr. W. Foulis) and Sir William Arrol.

At this point the lecturer gave a description of the arrangements for dealing with the coke—the 2-feet gauge railway throughout the retort-houses, and the small locomotive engines for drawing the tipping-waggons employed in carrying away the surplus coke from the retorts. He also described the gantry, 300 feet long, built parallel to each coke-tipping bank; the steam travelling crane for working upon the gantry; and the coke-screening machines, producing fine breeze, riddled breeze, and coke. The riddled breeze was used for bolt and rivet making furnaces; and the coke had a wide sale for many purposes.

Mr. Wilson then went on to show what happens after the charging-machine has placed the coal evenly in the retort. He said that the temperature at which the retorts were kept is about 1800° to 2000° Fahr. As soon as the charge was put in and the lid was closed, the heat began to act, and the different constituents of the coal, which had kept together in peace and quietness for long ages, were forced to part company at last. Each retort was charged every three hours; this being a sufficient time for all the volatile portion of the coal to be disengaged from the carbon or coke, which was then pulled out by the drawing-machine before a new charge was put in. The gaseous and liquid products passed up the ascension-pipes, being partly cooled on their way; and as they bubbled up through the liquor seal at the bottom of the dip-pipes, the heavy tar and most of the steam or water were disengaged from the gas, and left in the hydraulic main, from which they were taken away by a separate pipe to the store-tanks—a sufficient quantity being always left in the hydraulic main by means of a regulated overflow to maintain the proper depth of seal. At this stage the bulk of the gas consisted of hydrogen and methane; but it also contained cyanogen, carbonic acid, sulphuretted hydrogen, and a variable amount of gaseous hydrocarbons, ammonia, and certain other nitrogen and sulphur compounds. Of these the sulphuretted hydrogen, carbonic acid, and ammonia had to be removed, as they were detrimental to the use of gas for lighting purposes. The gas left the hydraulic main by means of a suitable outlet, and was conducted by the relieving or foul main to the condensers. [The nature of the condensers and how they were worked were here shown by a diagram projected on the screen.] The lecturer next described the exhausters—Beale's and Donkin's—and followed the gas to Walker's purifying-machines, which were explained at some length. The water, he said, in passing from compartment to compartment of the purifier

absorbed more and more ammonia, until, by the time that it was run off from the tar-extractor to the store-tank, it was ready to be pumped up to the chemical works adjoining, to be utilized in the manufacture of sulphate or other ammoniacal compound. He then dealt with the removal of the sulphuretted hydrogen and carbonic acid, and in doing so started with the calcining of the limestone; describing the limekilns, the purifiers, and how they were worked, and the preparation of the foul lime for the use of farmers.

Having lost the last of its removable impurities, Mr. Wilson said the gas was now fit for being put into the holders; passing on its way through the station meters, which were made on exactly the same principle as the ordinary consumer's wet meter, which he somewhat minutely described. Full information as to the design and construction of a large gasholder (and tank) would, he said, form a most interesting paper by itself; but time would only allow of the same general description as had been given of other parts of the works. The construction of the large tank at the Temple works was hurriedly described, as also the holder. In making the tank for the large holder erected a few years ago, about 90,000 cubic yards of material had to be excavated, some 4,000,000 bricks used, and altogether about 20,000 cubic yards of puddle and building materials put in. Something like 200 working days were required for the construction of the tank; and, on an average, 1000 tons of material were handled every day.

With the gasholder, Mr. Wilson said the manufacturing part of the plant came to an end; but before the gas was sent out to the consumers, it was regularly tested for its illuminating power. A rough test was constantly taken in the works by means of a jet photometer; but the more scientific tests were made by the bar photometer, which the lecturer described at some length, as also the mode of using it. With this he closed his discourse.

In the course of the lecture, Mr. Wilson used between thirty and forty lantern slides in its illustration. It gave great satisfaction; and a very hearty vote of thanks was passed to the author.

ELECTRIC LIGHTING NOTES.

At the meeting of the London County Council last Tuesday, a scheme for lighting by electricity the roadway and parapet wall of the Victoria Embankment and Westminster Bridge and its approaches, at an estimated cost of £25,300, was adopted on the recommendation of the Highways Committee. The maintenance is estimated to cost £3500 a year.

The Newington Vestry have decided to apply to the London County Council for a loan of £40,000 for the purpose of erecting an electric lighting station in Penrose Street, Walworth, despite the fact that Mr. Kirke declared the scheme to be "a gigantic fraud on the ratepayers, and a scandalous waste of money." Mr. Manville, the Vestry Engineer, said after a few years they could obtain a further loan for the extension of the installation, should the proposed scheme prove successful.

The Directors of the Sheffield Electric Light Company have been greatly incensed by certain reflections made upon their good faith in the negotiations for the sale of their undertaking by several members of the County Council at their meeting on the 10th inst.; and, through the Company's Solicitors, they forwarded a letter to the Town Clerk suspending the negotiations. The letter has been under the consideration of the Corporation Parliamentary Committee, who have caused a reply to be sent expressing their regret that the negotiations have been suspended, and their opinion that "the Directors are fully acquitted of any improper secrecy or conduct in connection with the negotiations." The Committee also trust that the terms agreed to by the Council will be accepted by the Company.

A short report on the subject of the purchase of the electric lighting works was laid before the Shrewsbury Town Council yesterday week by the Lighting Committee. It stated that the Corporation Electric Lighting Order had passed the Standing Orders of the Board of Trade; but a memorial had been deposited with the Board, signed by six persons, nearly, if not all, of whom were interested in the Shrewsbury Gas Company, objecting to the proposed purchase. The Committee recommended that the corporate seal should be affixed to an agreement with the Company, and also that a conditional contract should be entered into for the purchase of property adjoining the Company's works with the view to their extension, in order to meet the demands of private consumers, and to provide for the lighting of the streets and public buildings.

Several matters involving additional borrowing powers on the part of the Corporation were inquired into at Manchester last Tuesday by Colonel W. L. Coke, representing the Local Government Board. Among the items was an application for sanction to a loan of £16,000, required for acquiring land for new electric lighting works. The present station is now being extended; but the Council, having obtained powers to work the tramways of the city by electricity, and to undertake the electric lighting of surrounding districts, they have decided that the establishment of additional works is absolutely necessary. During the evidence, the Inspector intimated that he was glad to hear that the Corporation were proposing to use electricity as the motive power for the tramways. He had been converted to the view that this was desirable by a visit to Canada. In his opinion, England was very backward in this respect.

Cagliari Gas and Water Company, Limited.—At the ordinary general meeting of this Company on the 1st prox., the Directors will report that the receipts on revenue account for the past year amount to £22,167, and the expenditure to £11,313; leaving, after the usual deduction for the sinking fund, a net revenue of £10,854 for the year. The amount available for distribution, including the balance brought forward, is £16,204, out of which an interim dividend at the rate of 6 per cent. per annum was paid for the six months ending June 30, 1897, amounting to £4520. The Directors recommend a dividend at the rate of 8 per cent. per annum for the second half of the year, amounting to £6000; making 7 per cent. for the year. They also recommend that a bonus of 2s. 6d. per share should be now paid. This will amount to £937, and leave a balance of £4766 to be carried forward.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

Expenditure on Inquiries and Promoting Bills.

On the 3rd of August last year, the House of Commons, on the motion of Sir F. Dixon-Hartland, ordered a return "showing the amount expended by the London County Council since the year 1890 to the present time (*a*) in prosecuting and conducting inquiries and negotiations relative to the supply of water, or Companies supplying water, in or near the Administrative County of London, under the London Council (General Powers) Act, 1890 (53 & 54 Vict. cap. 243), section 38, which sum was limited to £5000; (*b*) in making inquiries as to the existing supply of water within the Metropolitan Water Area, and the charges made for the same, and as to the possible sources of supply, under the London Water Act, 1892 (55 & 56 Vict., cap. 130), which was limited by section 3 to a sum of £10,000 in addition to the sum which the Council were authorized to pay for similar purposes by section 38 of the London Council (General Powers) Act, 1890, above mentioned; (*c*) distinguishing any sums expended upon like purposes during the period in question which may have been considered as properly applicable to the cost of the promotion of any Bills in Parliament dealing with the general question of water supply within the whole of the Metropolitan Water Area." The return was presented, and was ordered to be printed on the 10th inst. It was issued last Wednesday. It shows that the Council had spent, up to Aug. 3 last, the whole of the £5000 referred to under (*a*), and £7026 0s. 1d. of the £10,000 mentioned in (*b*). With regard to (*c*), the Comptroller of the Council (Mr. H. E. Haward) states as follows: "There are no sums expended under heads (*a*) and (*b*) which are to be 'distinguished' as properly applicable to the cost of the promotion of Bills in Parliament; but, as the Council are anxious to avoid any misapprehension that might arise if they confined themselves strictly to the information asked for, I am directed to add that the total sum expended by the Council in promoting Bills in Parliament relating to the supply of water in the Administrative County of London has amounted to £29,900 13s. 3d., and this sum is additional to the sums specified above."

THE METROPOLITAN WATER SUPPLY COMMISSION.

Tenth Day—Monday, Feb. 14.

(*Viscount* LLANDAFF, *Chairman*, *Sir* JOHN E. DORINGTON, Bart., M.P., *Sir* G. B. BRUCE, M.Inst.C.E., *Major-General* A. DE COURCY SCOTT, R.E., *the Right Hon.* J. W. MELLOR, Q.C., M.P., *Mr.* A. DE BOCK PORTER, C.B., *Mr.* H. W. CRIPPS, Q.C., and *Mr.* R. LEWIS.)

The Commission sat again to-day in the Moses Room of the House of Lords.

The following are the Counsel engaged: Mr. POPE, Q.C., and Mr. CLAUDE BAGGALLAY, Q.C., for the New River Company; Mr. LITTLER, Q.C., and Mr. LEWIS COWARD for the Kent Water Company; Mr. PEMBER, Q.C., for the Lambeth, East London, Grand Junction, and West Middlesex Water Companies; Mr. RICKARDS for the Chelsea Water Company; Lord R. CECIL for the Hertfordshire County Council; Mr. BALFOUR BROWNE, Q.C., and Mr. FREEMAN, Q.C., for the London County Council; Sir R. NICHOLSON for the Middlesex County Council; and Mr. GABRIEL P. GOLDNEY (Remembrancer) for the Corporation of the City of London. The Southwark and Vauxhall Water Company are represented by Messrs. BIRCHAM AND Co.

Mr. *G. L. Gomme*, examined by the CHAIRMAN, said he was Statistical Officer of the London County Council, and had prepared certain details about provincial purchases of water undertakings. The first case was that of Glasgow. In 1806, the Glasgow Company commenced to supply; and in 1808, the Gorvals Company entered in competition. In 1834, the two Companies tried to amalgamate; but the Corporation successfully opposed the scheme, on the ground that it would deprive the Municipality of the benefit of competition. In 1838, Parliament sanctioned the amalgamation, but imposed very stringent conditions, including the restriction of the rate of charge to 6½ per cent. practically, on the rateable value as distinct from rental value, with a maximum charge of £10 per house, and a limitation of dividends to 7 per cent. In 1855, the Corporation obtained powers to purchase the Companies and to get a new supply. For the Glasgow Company the terms of purchase were 4½ per cent. on the nominal amount of the ordinary stock and 6 per cent. on the preference stock; and for the Gorvals Company, 6 per cent. on the ordinary shares. This represented an average of 5·13 per cent. upon the total capital of the Companies, although at the time of purchase they were paying 6 per cent. on their stock, both ordinary and preference. These terms were agreed. The Corporation expenditure since in respect of new works amounted to over £3,000,000, on which they were paying 3 per cent. The total interest on the annuities was £26,967. Thus the Corporation were paying 5·13 per cent. upon the capital of £525,380 of the two Companies, and 3·02 per cent. upon their own capital of £3,000,000. This worked out to an average of 3·33 per cent. for the entire capital of the water undertakings.

The CHAIRMAN: What became of the water-rates after purchase?

Witness: They have been reduced from 5 per cent. on the rateable value in 1856-7, to 2½ per cent. at the present time—a reduction of one-half. Witness added that a rate of 1d. in the pound was now being raised in aid; but for how long this had been done, he could not say. There were no extras, and the supply was perpetual. The rate in aid was for the purposes of the town—sewer flushing, street watering, baths, Corporation buildings, cattle troughs, and public urinals—and it also included the water supplied to charitable institutions and hospitals. The rate at present charged was 6d. in the pound within, and 10d. outside the borough.

Mr. PEMBER, with reference to a question put to witness, said the Act provided that the Corporation were to set apart as a sinking fund for ten years, after the expiration of ten years, a sum of not less than 1 per cent.; and after the expiration of twenty years, a sum of not less than 1½ per cent. There was no sinking fund for the annuities.

Witness next dealt with the case of Birmingham. The Company expended £621,600 on works and in respect of this perpetual annuities

were to be paid amounting to £47,712. On capital called up and not expended—amounting to £50,400—annuities of 7 per cent., equal to £3528, were allowed; for capital not called up—amounting to £84,000—annuities equivalent to £2376 were given; and in respect of back dividends, £875 annuities were created. This made a total of annuities of £54,491. The capital amounted to £672,000; so that the rate was 8·1 per cent. For the first time, in 1876 (the date of purchase), the Company paid their maximum dividend of 8 per cent. on £420,000 and 7 per cent. on £201,000. Since 1876, the Corporation had spent £1,512,474 on further works, on which they were paying 2·9 per cent. for interest. This worked out to an interest of 4·4 per cent. which the Corporation had to pay upon the entire water undertaking. The domestic rate the Corporation were now charging was the same as that of the Company, but with a considerable reduction in the case of shop property, which was in the heart of the city, where the rateable value was high. The scale of charges for trade consumption was, he thought, rather lower than under the Company. There was no rate in aid in Birmingham. There were some extra charges. Immediately after the purchase, and for some years, the Corporation considerably reduced their charges; and it was only when the new works were undertaken, that the old scale was resorted to. The Corporation after the purchase paid more than the old shareholders received; and they also had to provide interest and sinking fund on £1,500,000.

The Chairman: I do not understand how the same charges would suffice to pay these sums?

Witness: Well, the same amounts did suffice to do so, and to produce, also, to the Corporation a considerable profit. Witness then went, in some detail, into the charges at Birmingham as compared with those in London; the result being to show that in London for houses at or under £30 less was charged than in Birmingham. Out of the profits of previous years, they had accumulated a reserve fund of £50,000, and a special water fund of £78,000. The interest on the reserve fund (£2000) was transferred to the borough fund, and diminished the borough rates to that extent. The Birmingham Corporation supplied, and charged at the same rate as in the borough, four urban districts and five rural districts. In the case of Sheffield, the purchase, which took place in 1888, was at a time when the Company were paying only 1½ per cent. on the ordinary shares, and 4 and 5 per cent. on the preference shares—an average rate of 3¾ per cent. The capital was £461,850 ordinary shares and £874,350 preference shares. Under the agreement to buy, the Corporation paid annuities at 3 per cent. in respect of £461,150 ordinary capital—£13,835; dividends on Corporation stock in lieu of £700—£20; and in respect of preference shares, annuities at 4 per cent. on £11,200—£448; and annuities at 5 per cent. on £863,150—£43,157. This made, for a total capital of £1,336,200, interest equal to £57,460; or an average of 4·3 per cent. on the capital. The annuities were redeemable after 1947, at 25 years' purchase. As to the water-rates now charged, he pointed out that, owing to the bursting of the Dale Dyke Reservoir, which caused an expenditure of £373,000, the Company obtained power from Parliament to increase their charges by 25 per cent. for a period of years. Afterwards an extension of that time was granted. Since the purchase, however, the extra 25 per cent. had been remitted, and the rates were now the same as before the reservoir disaster. In addition to this, the Corporation each year transferred to the borough funds in relief of the rates a large sum of money. In 1896-7, this sum was £4523. There was no municipal rate in aid.

The Chairman: In all the cases you have given, I do not see that the Companies have got anything for prospective increase in their revenue. Purchases have all been calculated on perpetual annuities, amounting to percentages on the capital of the Companies?

Witness: Yes.

I do not see any separate item for prospective income?—Except the additional interest they are allowed.

Mr. Pember: Apparently money was allowed for prospective increase in the Birmingham case, because they got 8·1 per cent. on capital, part of which was receiving only 7 and some 8 per cent.

Witness (continuing) proceeded to deal with a case of a Joint Water Board—that of Middlesbrough. The purchase took place in 1878, when the Company were paying maximum statutory dividends. The Authorities concerned were the municipal boroughs of Stockton, Middlesbrough, and Thornaby, and four urban and seven rural districts. The capital was £182,588 ordinary and £67,800 preference shares. The purchase was effected by the Stockton and Middlesbrough Corporations; and the undertaking was then transferred to a Trust, on which they, with the Thornaby Authority, were represented according to the number of population. Outside these Authorities there was a population of 46,457 which was unrepresented. The terms were 25 years' purchase of the maximum dividend of £18,647—£466,175; compensation for compulsory purchase and prospective value—£213,802; and debts and liabilities of the Company at time of purchase—£126,073. This made a total of £806,050. The Company charged 7½ to 4 per cent. on houses up to £50 gross rental value; 4 to 3 per cent. on houses between £51 and £100; and 3 per cent. on houses above £100. The Trust now charged 7½ to 6 per cent. on houses up to £50, and 6 per cent. on those above £50. Since the purchase, the Trust had used the old sources for trade purposes simply; having obtained a fresh supply for domestic consumption, at a cost of £997,341. The outside districts which had no representation paid 25 per cent. more for their water than the others. Out of a total consumption of 70 million gallons a week, 54 million gallons were for trade; and for trade purposes the Trust made a large reduction, though they knew that a heavy deficit would result, which must fall on the borough rates. Last year the deficit was £26,629. The Trust adopted this course believing that they were converting the loss—which was growing less year by year—into a profit, by reason of the increasing quantity of water they were selling. Witness did not believe there was any analogy between purchase in London and in the Provinces, because the circumstances were so different. In the Manchester case, the Corporation paid by means of perpetual annuities at 3 per cent. in respect of £635,400, and at 5 per cent. in respect of £64,273. In addition to this they took over £100,000 of loan capital at 4 per cent. The transfer occurred so long ago as 1851; and witness could not therefore give the complete figures. The purchase all round took place at 3·3 per cent.; and on £5,456,373 spent since the same rate of interest was being paid. He could not say now what rates the Company used to levy. The Corporation at present charged 3¾ per cent. on the rateable value of all classes of property for domestic consumption; and there were no extras at all. Then there was a municipal rate of 3d., levied by the Corporation by Special Act directly upon owners of property, for public purposes—such as sanitary arrangements, fire, &c. He believed the ordinary charges were the same as in 1851.

The Chairman: Then the consumers have obtained no reduction, and the owners have had a 3d. rate levied upon them?

Mr. Balfour Browne: With the £5,000,000 of expenditure, no further burden has been put upon them.

Witness: They have a better supply; and they have included in their public charges certain items which we in London have to pay extra for. Continuing, he handed in a table showing that the power of competing against one another had been granted to two or more of the eight London Companies in areas representing 75·5 per cent. of the population; and that in areas representing only 24·5 per cent. of the population was the right possessed of supplying without competition. In the case of extra London, the corresponding figures were very different—namely, 16·3 and 83·7 per cent. respectively. He drew the conclusion that the revenue derived from the districts in which Companies had power of supply without competition would be more valuable than income drawn from other districts, because the time might come when Parliament would force the Companies to compete in the areas where such power already existed. He also handed in another set of tables showing how, in cases where the Companies had been forced to compete, the result had been valuable to the consumer and prejudicial to the Company—there having been a reduction of rates. In the case of the competition between the Southwark and Vauxhall and Lambeth Companies, the reduction was 22 per cent. of the total statutory charge. Witness handed in and explained several other tables.

Eleventh Day—Tuesday, Feb. 15.

The inquiry was continued to-day, all the Commissioners being present except Mr. Cripps.

Mr. *Gomme*, further examined by the Chairman, handed in a detailed analysis of the water accounts of such county boroughs and corporations in England and Wales as had control of their water supply for the year 1896-7; also of Dundee, Edinburgh, and Glasgow, for the same year. Another set of figures which he handed in gave the revenue, expenditure, and dividend per million gallons average daily supply in the year 1896-7 of the eight London Companies. In every case, the amount devoted to dividend and interest exceeded the expenditure on services. The range of revenue was from £7263 to £15,083 per million gallons average daily supply. These variations were caused by influences operating differently in the case of each Company. It was significant that the range of annual expenditure was nearly the same as that of revenue; being from £3520 (Southwark and Vauxhall Company), to £6192 (New River Company). The only explanation seemed to be difference in the methods of administering the services. Either the Companies spending the larger sums were laying out too much, or those spending the smaller amounts were starving their works. In the former case, the water consumer would be deprived of advantage in the reduction of charges which might otherwise result.

The Chairman: Anybody buying one of these starved Companies would be buying a rickety concern.

Witness: That would be so to some extent; but I assume it would be considered in the purchase price. The Companies, witness continued, of small expenditure were also those paying small dividends, and *vice versâ*. The table indicated the necessity of the water supply being either in the hands of a controlling or municipal authority, who would take care that sufficient, but not more than sufficient, was spent on the maintenance of the works. At present, the County Council had no such power. Water for trade purposes was sold in some cases by agreement, and in others by parliamentary scale. The Chelsea, Kent, and Lambeth Companies had no statutory scale; the others had. The Chelsea Company charged 1s. per 1000 gallons.

One shilling per 1000 gallons? That is enormously higher than the statutory rates?—Yes; that is the average rate they charge the Council for water for trade purposes—other than domestic, fires, parks, &c. About 20 per cent. of the total quantity the Companies supply is used for trade purposes. Witness produced tables giving the revenue per 1000 gallons total annual supply, both trade and domestic, in the case of each of the eight Companies, the effect of which was to show that the rates varied very considerably from time to time with each Company, and that the charges of one Company, as compared with those of another, also varied greatly. The next table was one giving the capital of each of the Companies per million gallons of average daily supply in 1896-7, together with the date of establishment of each Company. The figures were: Kent Company, 1809, £60,781; East London Company, 1807, £72,190; New River Company, 1620, £103,452; West Middlesex Company, 1806, £76,879; Lambeth Company, 1785, £80,756; Southwark and Vauxhall Company, 1805, £81,708; Grand Junction Company, 1811, £88,946; and Chelsea Company, 1721, £105,268. This seemed to suggest that the dates at which the Companies began had very much to do with the amount of capital. Thus of the two Lea Companies, the capital of the New River Company, which dated from 1620, was £103,452 per million gallons, while that of the East London Company was only £72,190. If there were to be a new system of control, a start should be made by reducing the capital to equate with the cost of the works. This would have to be done by Parliament, as in 1852, when they revised the capitals of the Companies, fixing, for instance, the Chelsea Company's capital at £300,000. An Arbitrator, he should think, would ascertain the proportions between capital representing works in use and obsolete plant.

Mr. Lewis: Is it your suggestion that Parliament should examine the expenditure since 1852, and cut it down?

Witness: I suggest, if we are to have control, Parliament should not begin at 1852, but should cut it all down to its effective use at the present moment, in order to get the capital earning income now.

Mr. Mellor: You want to exclude dead capital?

Witness: Yes.

The Chairman: A certain number of the shareholders are to be struck out of the shareholders' list without compensation?

Witness: No; I would rather reduce the value of the shares to each shareholder, as in 1852 the West Middlesex shares were reduced to £60 odd. It does not matter to the shareholders whether the obsolete capital is eliminated or not, seeing that it earns nothing; but it matters a great deal to the consumers.

What you suggest sounds like a very drastic control?—I think it is a reasonable thing to ask on behalf of the consumers. It seems to me that the only capital that should be considered at the present moment is the value of the works in effective use.

By Mr. MELLOR: If the Companies revised their capital as ordinary trading companies do, and wrote off a sum every year for depreciation, the revision now suggested would not be necessary.

Mr. LEWIS: How would you deal with a Company that had no limitation of dividend?

Witness: If we obtained control, we could make a limitation. Witness pointed out, as an instance of capital having become obsolete, that some of the old Companies had abandoned intakes, the money expended on which was still included in the capital of the Companies. He then went at great length, by means of a series of tables, into particulars as to the periods at which the Companies had raised their capital, what percentages these successive creations of capital bore to the present total, &c., with a view to suggesting a revision of the respective capitals. In the case of the Chelsea Company, Parliament in 1852 fixed their capital at £300,000; yet in the first year when the public audit was instituted, the published accounts (on which these tables were based) showed a capital expended prior to 1852 of £364,959. Not being a lawyer he could not say that the inclusion of the £64,959 was illegal; but he did not know by what authority the amount was included. Dividend was paid on this £64,959. He suggested that, in the case of all the Companies, capital which had been expended on works which were not now producing dividend should be regarded as obsolete, and dividends should not be paid upon it. Thus in the case of the East London Company, he suggested that the £130,000 which represented the purchase of the works of the Shadwell Company in 1809—which works included a lot of wooden pipes, and so on—was obsolete; yet it still received dividend. Although purchase, if carried out, would be on the basis of the income of the eight Companies, these matters should be considered as affecting the stability of the income. The capital of the Lambeth Company was fixed in 1848 by Parliament at £226,000. But ever since the public audit, they had put their capital at £313,000 or £87,000 excess; dividend being paid on the whole sum.

Mr. PEMBER: I am not prepared with an answer to that; but I will have it looked into.

Witness (proceeding) said in the audited accounts of the New River Company for June, 1871, a note appeared stating that the dividend included income arising from landed estate, houses, property, &c., not directly used for their water supply, and which, in future, was not to be included. Following that, the Company excluded from revenue the rents from that property; but they did not exclude the corresponding value of the property from the capital, so that it still participated in the water dividend. Even though the Company could divide unlimited dividends, this matter was still of importance, because he thought the Company would not care to divide a much greater dividend than at present. With reference to the Southwark and Vauxhall Company, he pointed out that they had in their accounts an item of £40,481 more than Parliament sanctioned. In all, he suggested that some £3,510,855 should be revised severely by Parliament. That was in respect of the period from 1871, and only covered items which had been picked out of the published accounts. In addition, there would also probably be items in the period from the establishment of the Companies up to 1871 which would need revising. It would be for Parliament to carry out this revision, which should in future be done periodically. Turning to the revenue of the Companies, he said they had really a power to tax, because the charge they made had no reference to the amount of water consumed. The New River Company had, he believed, made special terms with the City; and there were other cases of the kind. The proper way of charging was that adopted by Municipalities generally—namely, the taking of certain classes of property, grouping them, and charging a given rate on the rateable value, according to the necessities of each place—whereas the Companies in London did not do this, but made arrangements with particular consumers. This seemed unfair to the rest of the consumers, though it was not illegal. The only remedy he could suggest was that the charges of the Companies being taxation, the whole matter should be in the hands of a municipal authority. It would be undesirable to charge by meter, because with small property in the East-end of London, where the owners paid all taxes, including the water-rate, there would be a strong inducement to unduly economize—to consume less water than sanitation required. The poorer parts of London paid a greater percentage for their water than the richer. He was decidedly in favour of a revision of the charges, as well as of the capital of the Companies—supposing control was to be provided. The power of each Company to charge was as follows; the first figure being the rate per pound of rateable value, and the second the rate per cent. of rateable value: Chelsea Company, 8·6d. and £3 11s. 7d.; East London Company, 12d. and £5; Grand Junction Company, 8d. and £3 6s. 5d.; Kent Company, 12·7d. and £5 5s. 9d.; Lambeth Company, 15·4d. and £6 8s. 2d.; New River Company, 8·4d. and £3 10s. 1d.; Southwark and Vauxhall Company, 12d. and £5; and West Middlesex Company, 8d. and £3 6s. 7d.—the average being 9·8d. and £4 1s. 10d. respectively. Thus the South and East of London were more heavily charged; the West-end and villa region being lightly burdened. He could suggest no remedy except purchase; believing that efficient control was impossible. To reduce the rates all over London to the lowest charge, would cost £161,155, which would mean a rate of a little over 1d. in the pound. Another table showed the expenditure, and equivalent rate in the pound of such expenditure, of the Local Authorities in London; and in connection with this, he stated that whereas in provincial cases, where the control was in the hands of the local authority, this expenditure was included in the charges of the Municipality, in London it was a separate charge. Witness proceeded to point out, by means of a number of tables, how enormously the Companies had benefited by the great increase in rateable value (on which the Companies' charges were levied) which had taken place generally over London. Roughly, from 1871, when the new system of valuation came into operation, 40 per cent. of the increase that had taken place was due to re-valuation of the same buildings, and 60 per cent. to the erection of new buildings. He held that Parliament, even as late as 1852, when the general revision of the Companies' rates of charge, &c., took place, had not in view the enormous increase that had occurred. If the Commission adopted the principle of control, they should take steps to prevent the incomes of the Companies rising as the rateable values rose. In conclusion, he gave some evidence as to the system adopted by the Local Authorities in fixing rateable values.

The Commission then adjourned till yesterday (Monday).

The twelfth sitting of the Commission was held yesterday—Lord Llandaff presiding—when Mr. Gomme was cross-examined at considerable length by Mr. Littler and afterwards by Mr. Pember.

SOUTHWARK AND VAUXHALL WATER COMPANY.

A Special General Meeting of the proprietors was held on the 15th inst. at the Offices, Southwark Bridge Road, to consider the Company's Bill in Parliament. Alderman Sir H. E. KNIGHT presided.

The SECRETARY (Mr. Montague Watts) having read the notice calling the meeting,

The CHAIRMAN stated that it was a Wharncliffe meeting, which he supposed was in theory a good meeting; and it was required to be held for what was no doubt a useful object—namely, to explain to the shareholders what the Directors had in their minds when making an application to Parliament. In practice, however, shareholders did not seem to care much about such a meeting; for, as he had found from a good deal of experience, the attendance at them was small. The Bill was exactly on the same lines as the temporary Act passed by Parliament last year, which he then explained at the Wharncliffe meeting, and which they no doubt had heard a great deal more about since. It was a Bill which they were compelled to introduce this year by direction of the House of Commons, as contained in the clauses of the temporary measure which they obtained last year. They had been under the impression that there was no limit to the quantity of water they could take from the Thames, provided that it was used for the purpose of supplying their district. Acting under this idea, they continued for some time to take more than the 24½ million gallons which they agreed upon with the Thames Conservancy. In 1894, however, when the Thames Conservancy Bill was before the House, a long inquiry into the matters contained in the measure took place before Mr. Jackson's Committee; and these agreements were referred to several times. The upshot was that there appeared to be considerable doubt as to whether the Company could or could not exceed the 24½ million gallons; and, to test the question, an action was brought by the Thames Conservancy, when Mr. Justice Mathew said that the agreements had been come to by Act of Parliament, and the Company were therefore restricted to taking 24½ million gallons. An injunction would have been issued; and it therefore became necessary for them to go to Parliament, and obtain a temporary Act so as to enable them to take such water as they wanted for their district. In consideration of this, Parliament bound them to introduce a similar Bill in the present year, so that the whole question might be discussed and thrashed out. They were asking Parliament to increase their power of taking water from 24½ to 45 million gallons. This, however, did not mean that they were going to take a million gallons, or even a single gallon, more water from the Thames than they were now taking, until the demands of their district required it. They were already consuming about 38 million gallons. Therefore, although they were applying for this increased power, it was simply to legalize what they were now doing; and the Thames would not lose a single gallon more water than at present. People were under a misconception, and thought that the Company were going to take double the water from the river that they were now taking; whereas they would continue to take the same quantity as at present, doing so, however, under parliamentary power and legally. In order to enable them to take this extra quantity of water, and to protect the Thames reasonably in the interests of others, it was necessary for them to follow out the directions of Lord Balfour's Commission of 1893, and considerably extend their storage reservoirs, in order that, when they did take an extra quantity of water from the Thames, they might do so at the time of flood or after flood, when there was a huge quantity of water—10,000 or 15,000 million gallons a day—going over Teddington Weir. Under their previous Bill, they had proceeded rapidly with the construction of storage reservoirs; and they would very soon be in the position of having 500 million gallons of water stored. But this was not sufficient to carry out the intentions of Lord Balfour's Commission, whose decision was universally respected by all. It was certainly a decision of more value than that of any previous Commission. The inquiry took place before men who understood the business they were dealing with; and the Directors felt the greatest desire, in the interests of the shareholders and of the public, to carry out the recommendations of the Commission. This necessitated their purchasing a considerable area of land at West Molesey. On this land, they would be able to construct reservoirs to hold about 1200 million gallons. This would give them a total storage of something like 1700 million gallons, which they considered ample to meet their requirements for a good many years to come. These were the powers they sought under the Bill. There was no doubt that they would meet with the greatest possible objection from those who were interested in preventing the Water Companies from doing their duty. In connection with some eight Bills which they had introduced, he had always been met, in fighting their interests in the House of Commons, by the same persons, who had endeavoured to prevent them from performing their duty; but the House had always seen the justice of the Directors' intentions, and had sanctioned the objects they had in view. There were only one or two questions which were likely to be disputed by other parties, who would oppose them for different reasons than those he had just stated. These parties would object because they thought that what the Company wanted to do might be done better in another way. There would be a difficulty in settling the point where the river was to be gauged. This, however, was purely an engineering question; and they could not go into it at the meeting. They were also promoting the Bill under the agreement they entered into last year with the Thames Conservancy. This agreement meant, among other things, that the conditions of the take should be similar to those which were settled in the Staines Reservoirs Act of 1895, *mutatis mutandis*. They had necessarily considered this; and they had deposited a Bill in perfect good faith, and,

as they believed, exactly in accord with their agreement with the Thames Conservancy. Some of their friends where they were going to construct these reservoirs had been alarmed at the proposals they had made to construct them very deep. This, again, was a matter purely of engineering evidence. They were building them in the same way as those on the north side of the Thames had been constructed; and they could trust their Engineer to erect them in a perfectly safe and satisfactory manner. At all events, he would be supported by engineering evidence of such a character that any fears which might be entertained should be removed. The Bill was open for the shareholders' inspection; and he would be extremely pleased to answer any questions. He concluded by proposing—"That this meeting, having considered the Bill introduced into Parliament in the present session, intituled 'A Bill to authorize the Southwark and Vauxhall Water Company to acquire lands, construct additional works, take additional water from the River Thames, and raise additional capital, and for other purposes,' approves thereof, subject to such additions, alterations, and variations as Parliament may think fit to make therein, and as the Directors shall approve."

Mr. C. M. VIALLS seconded the motion.

The CHAIRMAN, in answer to Mr. Makins, stated that £650,000 of additional capital would be required for carrying out the objects of the Bill; but whether it would be raised by debentures or by stock, would be as Parliament ordered. They proposed asking for an issue of debentures, as this was the way in which Parliament had ordered capital to be raised for many years. In reply to a further question, he said he did not think that the Commission which was at present sitting could affect their Bill in any way. Whatever decision the Commission might arrive at, the Company must have the water they required in order to meet the demands of their district; and whatever the result of the Commission might be, their decision could not be carried out for some years. Moreover, no matter what was done, the works proposed would be absolutely useful under any circumstances.

The motion was then put, and carried unanimously.

On the motion of Mr. MAKINS, a vote of thanks was passed to the Chairman for presiding.

The CHAIRMAN, in reply, said he hoped they would not have to trouble the shareholders with many Wharncliffe meetings in the future—nothing like they had done in the past. In fact, he looked forward to the time when their labours in this direction would be pretty well ended.

The proceedings then terminated.

GRAND JUNCTION WATER-WORKS COMPANY.

A Special General Meeting of the proprietors in this Company was held on Wednesday last, at the Offices, South Molton Street, W.—Mr. FREDERICK TENDRON presiding.

The CHAIRMAN, in opening the proceedings, regretted the Secretary was unwell, and unable to attend. One of the Directors was also unwell.

The ACCOUNTANT (Mr. Folkard) having read the notice convening the meeting,

The CHAIRMAN said that he would later on move the formal resolution which would endorse their approval of the Bill which was to be laid before Parliament. Its various clauses were only to carry out the spirit of the preamble. The first important clause was that authorizing the Company to purchase additional land, to enable them to enlarge the two reservoirs which they had the power to construct. The Engineers found that at a moderate expense they could greatly increase the storage capacity—from 2500 to about 3300 million gallons—by changing the form of a certain portion of the reservoir. To do so, however, involved acquiring some more land; and it would also be necessary to obtain land in substitution for some already acquired—this being at present devoted to sewage purposes. This had a double advantage. Although the sewage farm would not in any way have affected the reservoir, it might have influenced the sentiment of people. It was not pleasant to know that a sewage farm was within a short distance of the water-works; and therefore, in buying this land, they were compelled to buy other land, where the sewage operations could be carried on. Another reason for going to Parliament was that experience had taught the Engineers that it was absolutely necessary to close certain footpaths, and especially an important footpath which they took power to close in one of the clauses of the former Act, but which, in the hurry of the sittings before the Parliamentary Committee, was, according to certain lawyers' opinions, neutralized by a subsequent general clause. Going to Parliament in this way for power to purchase additional land, to enlarge the reservoirs, and to close certain footpaths, it became necessary for them at the same time to get power to make the debenture stock a trustees' stock, in the market value of which this would make a difference of at least 7 or 8 per cent. It was strange that their 4 per cent. debenture stock should have been issued at 150, and yet that the 3 per cent. debenture stock guaranteed by three Companies like the New River, the West Middlesex, and the Grand Junction, should have only fetched 102¼. They therefore hoped that they would have done a good thing for those who took the first allotment or sale of the debenture stock at 102½, as the latter might suddenly find that their stock was worth 108 or 110 in the market. They had only issued a little over £200,000; and they would probably, if the Bill passed, issue another £1,000,000. It therefore became an important consideration to get the stock taken up at the highest possible price. In order to be on the safe side, and to avoid going to Parliament once more before the works were finished, they were going to take power to raise £250,000 in addition to the £1,000,000 they had authority to raise at present. He hardly thought that they would like to have the clauses read providing for the carrying out of these various purposes. They would doubtless be satisfied to leave them entirely in the hands of the Solicitors who were responsible for them; and he did not intend taking up their time that morning by again going into the immense importance to all the Water Companies of the proposed works at Staines. He then moved:—"That the Bill proposed to be introduced into Parliament, and now read, entitled 'A Bill to authorize the Staines Reservoirs Joint Committee to execute further works, to amend in certain respects the Staines Reservoirs Act of 1896, and for other purposes,' be, and the same is, hereby approved, subject to such additions, alterations, and variations as Parliament may think fit to make therein and the Directors may approve."

The Right Hon. Lord KNUTSFORD seconded the motion.

A SHAREHOLDER said that he would like the Chairman to give them some estimate of the cost of the works.

The CHAIRMAN replied that the estimate before was £1,000,000. They were now going to Parliament for £250,000 more; and he concluded that their Engineers would have to prove that it was necessary to raise this amount. They therefore could not expect him to say anything which would lead them to believe that the works would be made for much less than the additional £250,000. The land would cost nothing as compared with the other expenses. They knew much better than they did before what the cost was likely to be, because they had got the contract for the works. They had purchased a certain amount of land; and they knew about what the parliamentary and professional charges would be. In addition to the former estimate of £1,000,000, they hoped therefore that they would expend less than the £250,000 they were now asking Parliament for; but they did not yet know that this hope would be realized. They were assailed by all the landowners; one demand being specially outrageous. For a small piece of land, which was worth perhaps £500, they had been asked £25,000. The other day they had a case before a Jury, where their valuation was about £15,000 and the owners' valuation £80,000; and he believed that the verdict of the Jury was for about £29,330.

Mr. JAMES SLATER said he regarded the proposal in the Bill as a most admirable one; and it showed that their Company, with the others, were trying to keep abreast with the demands for water of the best kind. It was a costly process; but it was the only way in which to meet the London County Council, who, he thought, were becoming a little more reasonable.

The CHAIRMAN then put the motion, which was carried unanimously.

WATER DIVINATION IN JAMAICA.

The following account of a water diviner's experience in Jamaica, furnished by a correspondent from Kingston, recently appeared in a Birmingham paper.

For considerably more than six months one of the fraternity of the willow wand has been exploring the nooks and valleys of the Gem of the Antilles, and more especially her desert places, in the hope and expectation that a full and flowing stream of limpid water would reward his mystic operations. But the object of his many peregrinations has not yet been attained. He came, he saw, but he left again with the forces of Nature in that tropical isle still unconquered, and carrying with him the jeers of the sceptical, the mournful complaints of erstwhile disciples—and also a considerable sum of public money in return for his valuable services. In reference to this latter, the parties responsible for his presence in the island are experiencing an uncomfortable shaking in their shoes; and the end of the matter, so far as this is concerned, is not yet. The causes which led to his coming to the Colony were as follows.

During the past two years, Jamaica has suffered extremely from long and continued droughts. Water at times was so scarce that it had to be conveyed by railway in tanks from Kingston to spots where the supply was inadequate for the necessities of the inhabitants. Those who possessed springs on their properties had a *pro tempore* gold mine. Water was sold by the quart at extraordinary prices; and wells had to be guarded, night and day, by their owners, to prevent theft. This in a country whose name signifies "the Isle of Springs" was somewhat of an anomaly; and various schemes were proposed for the digging of wells and the locating of underground streams.

During the discussion of the matter, one of the honourable members of the Legislative Council of the island had gone on a visit to England. While there he was taken with the then popular craze of water-divining. He investigated the subject, saw the diviner himself, and wrote out to Jamaica advocating the engagement of one of these professional water finders. The Chairman of one of the Parochial Boards, and an ex-member of the Legislative Council, took up the matter vigorously in Jamaica. The proposal was made to several of the parishes whose inhabitants had felt the drought severely; it was excitedly canvassed and discussed; and eventually the diviner was engaged. His terms were the payment of his passage to and from Jamaica, maintenance while there, and a fee of £50 for each parish visited. Five parishes voted the sum required; and eventually the diviner arrived. He travelled over various parts of the country, and, rod in hand, pointed out innumerable spots where water would be found.

The enthusiasm was immense. He was followed by a huge crowd wherever he went; and his goings and comings from parish to parish became triumphal processions. He was entertained in a most royal manner. The houses of all were open to him; and two local companies were formed to carry on boring operations for water at the spots pointed out by him. True, one or two little incidents marred his triumphs; one, where at Mandeville—a charming village in the hills—he pegged out part of the course of a subterranean stream, and retired to a sumptuous lunch at a neighbouring hotel. In his absence, some wags removed his pegs, and lined out a totally different course. On his return, the diviner took up the new direction and continued it for upwards of 100 yards more, and did not discover his mistake until one of his admirers pointed out the deception. But no borings for water had yet been made, and the authoritative statements of the diviner were unchallenged. At length the necessary implements were obtained, and an attempt was made at several points to reach the water so confidently indicated. At one point where it was predicted as at a depth of 40 feet, a boring of 150 feet was made, with the only result that no water could be found. The machinery eventually broke down; and after going down about 200 feet, the borer could not be extracted. The same ridiculous result occurred in other places; and up to the present at none of the points indicated by the diviner has water been found. He has left the island discomfited; and the Auditor-General is now asking who is responsible for the £50 voted and paid by each of the five Parochial Boards. This incredulous official fails to see how public money could be legitimately used for fees to a water diviner, and has intimated that the parties responsible for the payments are personally responsible.

NEW WATER-WORKS FOR CINCINNATI.

A recent number of the "Engineering Record" contained a description of the above works, accompanied by a map showing the course of the conduits. The following particulars are taken therefrom:—

The water supply for the city of Cincinnati (Ohio), which amounts to about 235 million gallons per day, is now taken from the Ohio River through two intake aqueducts of masonry 12 feet and 16 feet in diameter to a pumping-station, which, though situated above the largest sewers discharging into the river, is still placed so as to receive a considerable amount of sewage and surface drainage from the uptown districts, from the cities of Newport, Dayton, and Bellevue on the Kentucky side of the river, and from the thickly populated Miami River valley. In order to secure a purer supply, it has been determined to build a new intake at a point near the village of California, on the river, sufficiently above the mouth of the Miami to avoid all contamination of the water except from remote cities and towns up the stream. At the same time, it was determined to instal a new pumping-system sufficiently large for the complete city service at a later date, when the present engines might be discarded. The pier of the new intake was located on the deepest point in the channel of the river, near the western shore; and from it a tunnel is to be built to a system of settling-tanks on about 350 acres of ground acquired by the city. The essentials of the scheme having been determined, the necessary legislation by the State and the U. S. Government was secured for the conduct of the work, and an appropriation was made by the city for its execution. A Board of Commissioners has been appointed to conduct the work, and Mr. L. F. G. Bouscaren made their Chief Engineer. This gentleman has developed the scheme so far as it has been determined upon, and made studies and alternative plans for the completion of the work, which will be formally decided upon and carried forward as fast as circumstances permit. The particulars here given were supplied to our contemporary by Mr. Bouscaren.

The inlet of the new intake is located near the Kentucky shore, where the water is 20 feet deep at its lowest stage. The inlet will consist of a masonry pier carried down to a solid rock foundation 30 feet below the bottom of the river, and rising 5 feet above the highest water. This intake pier will have two wells communicating with the river by openings at different elevations, provided with gates permitting the introduction of the water near the surface at different stages, and a central well connecting with the others by openings through which the water will be screened on its way to the pumps. The central well is connected by a shaft to a tunnel built in the rock under the river, and leading to the pumping-station on the Ohio shore. This tunnel, lined with brick masonry, will be of circular section 7 feet in diameter, and will be nearly 1400 feet long. It will end at a shaft sunk from the bottom of the pump pit, and will feed the suctions of three 30 million gallon pumps, which will deliver the water through two lines of 5-feet mains to two subsiding reservoirs formed by the construction of earth dams and grading to a uniform slope following the contours of two small valleys. The reservoirs will have a joint capacity of about 350 million gallons, and will afford a period of about three days' subsidence for the maximum supply of 60 million gallons contemplated by the present work. Sufficient ground will be acquired for the construction of a third reservoir at the same elevation, and for three more at an elevation of 30 feet above the others, when required by increased demand.

From these reservoirs the water will be filtered by gravity through sand or through mechanical filters; the method to be employed being dependent upon the results of experiments about to be made to determine the possibilities of sedimentation and sand filtration as applied to the purification of the Ohio River water. Experiments made with that water show that 80 per cent. of the sediment is precipitated in the first two days of subsidence, and that a large percentage of the bacterial impurities are removed by the same process simultaneously. The water issuing from the filters will be received in a covered clear-water well of about 20 million gallons capacity, which will act as a compensating reservoir between the uniform output of the filters and the irregular demand of the consumers. From the well the water will flow by gravity to a second pumping-station located in Cincinnati at Pendleton, within two miles of the Eden Park reservoir. This gravity conduit could be built in tunnel through the solid rock, in a straight line from a point on the Kentucky shore, opposite the California pumping-station, to the Pendleton pumping-station. This solution was abandoned on account of the objection to the location of so important a part of the work in Kentucky, and to the two crossings of the Ohio River which it involved. The principal difficulties on the Ohio side of the river were the crossing of the Miami River and of the low grounds of the Miami Valley, which are subject to long periods of overflow. The first plan considered was the building of a tunnel from the clear-water well to the west side of the Miami, and a conduit from thence to the Pendleton pumping-station. This conduit was to be built of steel shell, with an inside lining of brick as a permanent protection from corrosion. Careful measurements, however, determined that the tunnel conduit would have to rise above the hydraulic grade to cross the river by a bridge; so that a shaft and another tunnel and a second rising shaft would be necessary. The surface of the ground was found to be very badly adapted to its construction. Property damages would be high, and the difficulty, delay, and injury to traffic and streets involved in carrying it to the spot where it would have to be located were so great that consideration is now given to running it entirely in tunnel in as nearly a straight line as practicable from the well to the Pendleton pumping-station. This tunnel would be about 23,000 feet long; but it could easily be built in three years by using a sufficient number of intermediate working shafts.

The tunnel line was at first considered impracticable on account of the testimony of numerous well drivers who claimed that a large amount of work in this locality during the last fifty years had shown no rock within 150 feet of the surface. It was inferred that it would be exceedingly difficult, owing to the porous character of the soil, to drive the tunnel in the earth, and that if it was lowered to the rock it would be brought below the limits of compressed air depths. It was known that compressed air would probably be necessary in a tunnel, since the rock is known to be traversed throughout all this particular locality with numerous vertical streams filled with clay, but affording a

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 394.

Issue.	Share.	When pay. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 14	10½	Alliance & Dublin 10 p. c.	25—26	..	4 0 9
100,000	10	„	7½	Do. 7 p. c.	16½—17½	..	4 5 8
300,000	100	Jan. 3	5	Australian 5 p. c. Db.	105—107	..	4 13 6
200,000	5	Nov. 11	6½	Bombay, Ltd.	6½—7	−¼	4 12 10
40,000	5	„	6½	Do. New, £4 paid	5—5½	..	4 14 6
380,000	Stk.	Aug. 27	12	Brentford Consolidated	300—305	..	3 18 8
240,000	„	„	9	Do. New	230—235	+3	3 16 7
50,000	„	„	5	Do. 5 p. c. Prf.	145—150	..	3 6 8
159,375	„	Dec. 15	4	Do. 4 p. c. Db. Stk.	134—138	..	2 18 0
220,000	Stk.	Sep. 15	11½	Brighton & Hove Orig.	275—280	..	4 2 3
208,820	„	„	8½	Do. A. Ord. Stk.	200—205	..	4 2 11
933,500	Stk.	Aug. 27	5	Bristol, 5 p. c. max.	130—135	..	3 14 1
420,000	20	Sep. 30	11½	British	56¼—57½	..	3 18 3
50,000	10	Aug. 27	11½	Bromley, Ord. 10 p. c.	25—27	..	4 5 2
71,000	10	„	8½	Do. 7 p. c.	20—22	..	3 17 3
500,000	10	Oct. 14	6	Buenos Ayres (New) Ltd	9½—10½	..	5 17 1
98,122	Stk.	Dec. 30	4	Do. 4 p. c. Db. Stk.	97—99	..	4 0 10
150,000	20	July 15	8½	Cagliari, Ltd.	30—32	..	5 3 1
100,000	10	Sep. 30	8	Cape Town & Dis., Ltd.	17—18	..	4 8 11
50,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	59—61	..	4 18 5
550,000	Stk.	Oct 14	13½	Commercial Old Stock	340—345	..	3 18 3
200,750	„	„	10½	Do. New do.	255—260	..	4 0 9
200,750	„	Dec. 15	4½	Do. 4½ p. c. Db. dc.	154—157	..	2 17 4
800,000	Stk.	Dec. 15	12	Continental Union, Ltd.	249—254	..	4 14 6
200,000	„	„	9	Do. 7 p. c. Prf.	214—219	..	4 2 2
51,600	Stk	Aug. 27	14	Croydon A 10 p. c.	315—320	..	4 7 6
163,400	„	„	11	Do. B 7 p. c.	253—257	..	4 5 7
535,000	Stk.	Aug. 12	5½	Crystal Palace Ord. 5 p. c.	135—139	−1	3 11 11
60,000	„	„	5	Do. 5 p. c. Prf.	140—143	..	3 9 11
486,090	10	Jan. 27	11	European, Ltd.	25½—26½	..	4 3 0
354,060	10	„	11	Do. £7 10s. paid	18—19	..	4 6 0
5,922,110	Stk.	Feb. 10	12½	Gaslight & Coke, A, Ord.	298—303	−2	4 4 2
100,000	„	„	4	Do. B, 4 p. c. max.	120—125	+8	3 4 0
665,000	„	„	10	Do. C, D, E, 10 p. c. Prf.	317—322*	..	3 2 1
30,000	„	„	5	Do. F, 5 p. c. Prf.	150—155*	..	3 4 6
60,000	„	„	7½	Do. G, 7½ p. c. do.	220—225*	..	3 6 8
1,300,000	„	„	7	Do. H, 7 p. c. max.	201—206*	..	3 8 0
463,000	„	„	10	Do. J, 10 p. c. Prf.	316—321*	..	3 2 4
476,000	„	„	6	Do. K, 6 p. c. Prf.	185—190*	..	3 3 2
1,061,150	„	Dec. 15	4	Do. 4 p. c. Db. Stk.	138—141	..	2 16 9
294,850	„	„	4½	Do. 4½ p. c. do.	156—159	..	2 6 7
958,000	„	„	6	Do. 6 p. c. do.	205—210	..	2 17 1
70,000	10	Oct. 28	8	Hongkong & China, Ltd.	14—15	..	5 6 8
3,800,000	Stk.	Nov. 11	10	Imperial Continental	218—223	−2	4 9 8
376,400	100	Feb. 1	4	Do. 4 p. c. Dbs. Red.	98—101	..	3 19 3
473,600	Stk.	Feb. 10	3½	Do. 3½ p. c. Db. Stk.	103—105*	..	3 6 8
				* Ex div.			

Issue.	Share.	When ex-Dividend.	Unpaid or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
75,000	5	Dec. 15	6	Malta & Medn., Ltd.	5½—6	..	5 0 0
560,000	10	Oct. 1	5	Met. of Mel- bourne } 5 p. c. Db. 4½ p.c. Db.	113—114	..	4 7 8
250,000	100	„	4½		109—111	..	4 1 1
541,920	20	Nov. 11	5	Monte Video, Ltd.	15½—16½	+½	6 1 3
150,000	5	Nov. 26	8	Oriental, Ltd.	8½—8¾	..	4 11 5
135,000	5	„	8	Do. New, £4 10s. pd.	7—7½	..	4 16 0
15,000	5	„	8	Do. do. 1879, £1 pd.	1½—2	..	4 0 0
60,000	5	Sep. 30	7	Ottoman, Ltd.	4½—5½	..	6 13 4
420,000	100	Nov. 2	6	People's Gas } 1st M. Bd.	104—109	..	5 10 1
500,000	100	Dec. 1	6	of Chicago } 2nd do.	103—108	..	5 11 1
250,000	10	Sep. 30	10	San Paulo, Ltd.	16—17	..	5 17 3
135,000	Stk.	—	10	Sheffield A.	250—253	..	3 19 0
209,053	„	—	10	Do. B.	250—253	..	3 19 0
447,427	„	—	10	Do. C.	250—253	..	3 19 0
5,475,000	Stk.	Aug. 12	5½	South Metrop., 4 p.c Ord	146—149	..	3 10 6
1,416,667	„	Jan. 13	3	Do. 3 p. c. Db. Stk.	102—108	..	2 15 7
60,000	Stk.	Sep. 15	12	Tottenham and } A.	285—295	..	4 1 4
60,000	„	„	9	Edmonton } B.	205—215	..	4 3 9
182,380	10	Dec. 20	7	Tuscan, Ltd.	13½—14½	..	4 16 7
149,900	10	Jan. 3	5	Do. 5 p. c. Dbs. Red.	100—103	..	4 17 1
				WATER COMPANIES.			
746,164	Stk.	Dec. 30	10½	Chelsea, Ord.	335—340	..	3 1 9
150,000	„	„	5	Do. 5 p. c. Prf.	177—180	..	2 15 6
160,000	„	„	4½	Do. 4½ p.c. Pf. Stk., 1875	157—160	..	2 16 3
175,785	„	Sep. 30	4½	Do. 4½ p. c. Lb. Stk.	160—165	..	2 14 6
1,720,560	Stk.	Oct. 14	7½	East London, Ord.	233—237	..	3 3 3
654,740	„	Dec. 30	4½	Do. 4½ p. c. Db. Stk.	162—165	..	2 14 6
390,000	„	„	3	Do. 3 p. c. Db. Stk..	105—107	..	2 16 1
700,000	50	Dec. 15	7½	G'd Junct'n, 10 p. c. max.	122—127	..	2 19 0
295,000	Stk.	„	4	Do. 4 p. c. Db. Stk.	147—159	..	2 12 8
708,000	Stk.	Feb. 10	13	Kent	358—363	+1	3 11 8
160,000	„	„	7	Do. New, 7 p. c. max..	213—218*	..	3 4 3
1,043,800	100	Dec. 30	10	Lambeth, 10 p. c. max.	307—312	..	3 4 1
406,200	100	„	7½	Do. 7½ p. c. max..	230—235	..	3 3 10
350,000	Stk.	Sep. 30	4	Do. 4 p. c. Db. Stk.	147—150	..	2 13 4
500,000	100	Feb. 10	13	New River, New Shares	447—452*	..	2 17 6
1,000,000	Stk.	Jan. 27	4	Do. 4 p. c. Db. Stk.	148—153	+1	2 12 4
902,300	Stk.	Dec. 15	6	Southw'k & V'xhall, Ord.	166—169	..	3 11 0
126,500	100	„	6	Do. do. 7½ p. c. max.	162—167	..	4 9 10
489,200	Stk.	„	5	Do. do. 5 p. c. Prf.	175—180	..	2 15 6
1,019,585	„	Oct. 14	4	Do. 4 p. c. A Db. Stk.	146—149	−1	2 13 8
1,155,066	Stk.	Dec. 15	10	West Middlesex	319—324	+2	3 1 7
200,000	„	„	4½	Do. 4½ p. c. Db. Stk.	163—166	..	2 14 3
				* Ex div.			

very free flow of water. Borings conducted by the Engineer have demonstrated the rock to be found throughout the entire line at such depths as make compressed air work in it feasible. Invitations have been issued for tenders for the pumping-engines at the filter-beds; and when these contracts are awarded, others will be let for the pumps at the western station. This station has been designed for a present installation of four 20 million gallon high-duty pumps and four 500-horse power high-pressure boilers arranged in a house built with the view of extension in order to supplement them by four more 15 million gallon pumps and their boilers. Coal will be received from the river's edge, and unloaded into cars that will take it to the store, or be run directly on a track reaching within convenient delivery of the boilers so as to avoid rehandling. The cars are to hold a ton each, and move continuously around a double belt with switches from one line to the other, to enable them to return empty.

It is hoped that the entire work will be completed in 1901, within the limit of the appropriation of $6,500,000, which was not made, however, with reference to the present design.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

I am pleased to see that Bailie Wright, the Convener of the Works Committee of the Perth Gas Commission, has lost no time in taking Dr. Simpson, the Medical Officer of Health for the burgh, to task for the extraordinary report to which I called attention last week, and on much the same lines as I followed. He said that Dr. Simpson had not been able to give them a single case in which gas of any description had been the cause of death. Dr. Simpson recommended the construction of the Sanitary Department and the provision of a hospital; but his table on page 8 of the report took the legs from him, as it showed that the mortality from certain diseases treated in the hospital was much higher than in the case of those treated in their own houses. Dr. Simpson told them that everybody had been wrong. According to him nothing had been done in the right fashion, and Perth was in a most lamentable condition. He told them that the gas had been a nuisance—not only injurious, but actually dangerous to health—all over the whole town during the year. Would it surprise them to be told that this efficient Medical Officer of Health during all last year never said a single word in any report he sent in as to bad smells or anything else connected with the gas, and that the matter was brought before them by the Sanitary Inspector? Steps were at once taken by the Commission to have the things remedied; and the gas officials were instructed to use every endeavour to prevent a repetition of the nuisance. They might be sure that there had been no repetition, or Mr. Cumming would have been the first to have told them so. Instead of that, their Medical Officer, if he had really been their medical adviser, and wanted them to prevent the supply of bad gas in the town—if Dr. Simpson had been doing his duty as Medical Officer of Health—would have been hand in hand with the Sanitary Inspector, and gone to the Local Authority in a straightforward manner and had the thing remedied, without waiting till two months afterwards and printing in a report such offensive language as he used. He almost thought that Dr. Simpson should be added to the Gas-Works Committee. Dr. Simpson finished up with a matter he had little business to interfere with—namely, the quality of the gas so far as illumination was concerned. If he had any complaints to make in the future, not only in connection with the gas, but on any other nuisance in the city, it was his duty to come forward in a manly fashion and report the matter to the Committee, so that the Commission might take action, and not wait, as he had done in this case, till the nuisance had been removed. By circulating a report like this, and putting terror in the minds of a great many of the inhabitants in Perth, a great deal more was done to spread disease and death than by the gas complained of. Lord Provost Dewar said he would not say a single word in depreciation of the vigorous and conscientious report of the Medical Officer to the Local Authority, more particularly when the report dealt with what the Medical Officer was pleased to consider the delinquencies of the Local Authority. It was very important that local authorities should be kept at a very high mark; but Bailie Wright had put his finger on a distinct grievance. If Dr. Simpson was aware of a nuisance, it was his duty to draw the attention of the Local Authority to it; and it would then have been attended to. The Sanitary Inspector did this, and the Gas Commission immediately took action; and within 24 hours the thing was remedied. Everybody knew that in Perth they were carrying on the manufacture of gas under considerable difficulty at present, as their plant and resources were too small for the demand; but they were doing all they could. It was agreed to remit the annual report by the Medical Officer and the Sanitary Inspector to the Cleansing and Sanitary Committee.

If anyone has been living in expectation that on his next visit to the City of Glasgow the general sombreness of the scene would be somewhat enlivened by dazzling badges or uniforms worn by gas collectors and meter inspectors, he is doomed to disappointment. The Corporation, at their meeting on Thursday, by more than two to one, resolved that no such insignia be provided. The subject is in itself so trifling that I am surprised so much ado has been made about it. No disadvantage has accrued to the public in consequence of the gasmen going about unstamped; the promoters of the movement only feared that something might happen. They were, in fact, crying out before they were hurt. The men whose identity the promoters were anxious should be unmistakable to even the meanest understanding, objected to the proposed honour; and then the movement appeared to resolve itself into an attempt to humiliate the gasmen. If such were not intended, the subject, as it worked out, assumed very much that aspect. There are some people who seem to think that the whole community should be numbered and labelled; and that their work, their companions, their amusements, their dwellings, their wages, their whole surroundings, in short, should be selected for them by the State or the Municipality—a condition of things which, I fear, would be fraught with many disabilities to the individual. The supporters of this movement in Glasgow seemed to belong to that tribe of public men. Happily they are but a feeble folk, and cannot yet command the bodies to which they are attached; but see what a waste

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of public time they are responsible for. This proposal—of microscopic importance—was twice considered by a Sub-Committee, twice considered by the Gas Committee, and twice discussed in the Council.

The village of Carluke, in Lanarkshire, has grown to be of sufficient magnitude to require a gas supply. A Company has been formed; and on Monday last the Chairman (Mr. S. Pillans) performed the initiatory ceremony in connection with the erection of gas-works. Mr. Pillans wished success to the undertaking, and said he hoped the works would be as beneficial to the Company as they would be a boon to the community at large.

In Paisley, as in Edinburgh, there is a member of the Town Council who favours the establishment of an insurance fund for Corporation employees. On Tuesday, he moved the appointment of a Committee for the purpose of devising some means of establishing such a fund. He stated that upon every occasion when any of the employees in the gas-works met with an accident, they had great trouble between the Insurance Company and the individual. Another member thought they should make themselves acquainted with the provisions of the Workmen's Compensation Act before they took any such step as that proposed. This suggestion seemed to check the motion; but the author of it gave notice that he would bring it forward again at the next meeting of the Council.

A move, the significance of which I do not comprehend, was made by the Peebles Town Council last night, with reference to the position of the Gas Company. It appears that the Town Council are shareholders in the Company; and the Finance Committee recommended the Council to ask that the Company be wound up as at May 26 next. This recommendation appeared to have been given on the advice of Counsel, who went further, and recommended that the other shareholders should be asked to join in the request; but the Finance Committee thought the Council might not be disposed to go so far as that. The Town Clerk pointed out that the Council were acting illegally in remaining shareholders of an unregistered and unlimited company; and that even if they sold their shares, they would not rid themselves of responsibility, which would rest upon them individually, if not upon the town. Treasurer Williamson thought the town should acquire the undertaking, and so advance the best interests of the community. The recommendation of the Finance Committee was adopted. Now, unless it be for the purpose of promoting a transfer, I do not see what reason there can be for dissolving the Company; and if this be the object, it is a roundabout way of going to work. If the Company be wound up, and no transfer takes place, it must be re-constructed, and then the Town Council will get out. But they will not then be able to sell their shares; all that they can do will be to lift the value of the shares from the Liquidator. The other shareholders, it is to be presumed, will stick to the undertaking; and in this event, the withdrawal of the Town Council's shares would simply mean the extinction of so much stock, which would be for the benefit of the Company. But how this would help in the settlement of the question of whether the Company had appropriated town land, puzzles me to know. If a transfer took place, the question would settle itself.

Mr. Hubert Pooley, the Manager of the Dunfermline Corporation Gas-Works, reported to the Corporation this week an increase of over 1¼ million cubic feet in the output of gas last month. He also submitted a report upon the condition of the works, from which it appeared that the condensers, scrubber, and washer, which are of a capacity of 500,000 cubic feet per day, will next year probably be worked at their maximum; that there is only one set of exhausting plant, which is required to be worked night and day all the year round, with the exception of a few days in summer; that the purifiers are ample; that the station meter will be of sufficient size for the next two or three years; and that the mains are insufficient, requiring greater pressure to be employed, and leading thereby to an increase of the unaccounted-for gas, which last year amounted to 7·09 per cent. He is not satisfied with this amount, and considers that it might be reduced to 5 per cent., by which there would be a saving to the Commission of £222 annually. This economy would enable them to expend £3700 of capital upon the works. He recommends that the town should be divided into two districts for the distribution of the gas. The outlay he recommends is: On duplicating the exhausting plant, £470; on districting the town, £546; and on laying mains, £1136. The report was sent to the Gas Committee for consideration.

The Falkirk and Larbert Water Trust have been called upon to give an interpretation of their Act of Parliament which disposes of a very fine point of law. Application had been made to them to furnish a supply of water to the village of Polmont, which is several miles to the eastward of Falkirk. Acting on the advice of their Clerk, the Works Committee declined to do so, on the ground that Polmont was beyond the compulsory area mentioned in the statute. At a public meeting of the Trust recently, the Clerk was requested to give his reason for holding Polmont to be outside the compulsory area. His explanation was that certain villages and places were mentioned in their Act, as being themselves, and the districts and places adjacent, within the compulsory area; but it was not said that the villages adjacent to the places mentioned were to be held as within the area. His reading was that "districts and places adjacent" meant that they were obliged to give a supply to any house which might be immediately outside the places which were mentioned, but not to villages at a distance. The Trust adopted the Clerk's interpretation, and declined to give a supply; and in doing so they rejected a proposal to take the opinion of Counsel on the subject. The decision, unless it be upset in a Court of Law, may have effect beyond the boundaries of the Falkirk district.

The Edinburgh and District Water Trust have mortgages to the amount of £247,000 falling due in May next. To meet this sum, and also to provide for the outlays necessary in connection with the Talla works, the Finance Committee recommended, at a recent meeting of the Trust, that money be borrowed, to the amount of £300,000, upon mortgages bearing 2⅞ per cent. interest. Treasurer M'Crae attacked the proposal, and recommended his pet scheme for raising money by the issue of stock. By the mortgage system, he pointed out, the cost would be £7500 if for three years, or £6750 if for five years; and they were subject to the risk of a rise in the rate of interest at the expiry of the mortgages. By the stock system, the cost of raising £300,000 for thirty years would be only £750. Mr. Wood, the Convener of the Finance Committee, said they had considered the matter, and had resolved to adhere to the old plan; but if the Corporation raised a loan, probably the Trustees would borrow from them. This proposal met with approval.

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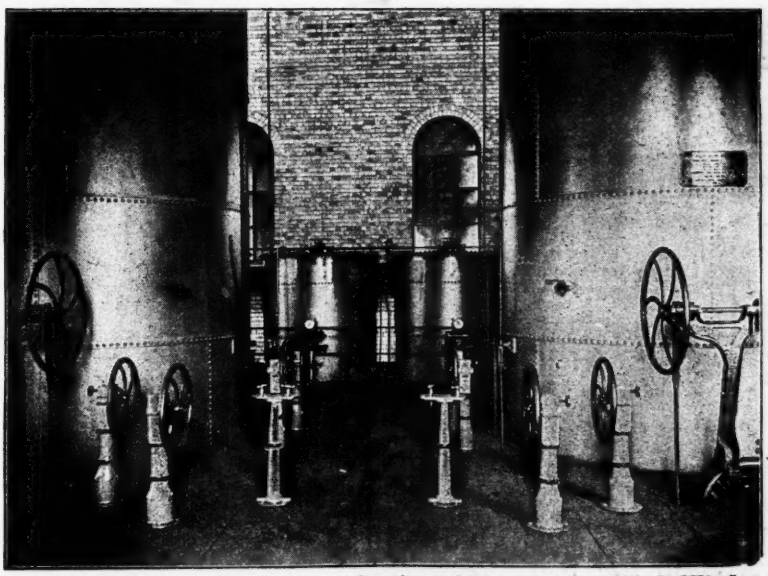

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CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Feb.* 19.

Sulphate of Ammonia.—There has been a quiet market at all points; and the closing quotation is £10 per ton, f.o.b. at ports. The demand has again been only moderate; and, having regard to the period reached, and to the continued open weather, the limited amount of buying seems to be scarcely natural. No doubt buyers found in the easier market during the first half of the month encouragement to continued postponement of purchasing; and it remains to be seen what the further requirements for February really are. It may be observed, meantime, that the business doing does not by any means fully represent the quantity actually being shipped; the bulk of the large makes having some time since been sold for February delivery—this, of course, coming into the February shipments. There is still very little interest in the forward position. Scotch and London makes are already sold well ahead, and makers are disinclined to reduce quotations; while, on the other hand, buyers are, in the face of a quiet spot market, disposed to wait for a better indication of the season's requirements than is yet afforded.

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LONDON, *Feb.* 19.

Tar Products.—There is a fairly active market in all products excepting pitch; and though there were hopes that the latter would see better prices before the end of the season, that period is approaching rapidly, without any important improvement taking place so far. The scarcity of creosote in makers' hands keeps that article strong, with a good demand. The open winter has brought about a much larger consumption during the last two months than is usual. The value of anthracene is maintained; and considerable job lots have changed hands. There is very little anthracene outside that held by the Committee; and, should the alizarine trade improve as is expected with the early spring months, a better price may yet be realized for that article. Solvent naphtha is also short in supply; and its price continues firm. The same condition obtains in respect to heavy naphtha, which is also much in request at the present time.

The average quotations during the week are as follows: Tar, 12s. to 16s. Pitch, east coast, 18s. 6d. to 19s. 6d.; west coast, 15s. 6d. to 16s. 6d. Benzol, 90's, 1s. 3½d.; 50's, 1s. 6d. Toluol, 1s. 8½d. Solvent naphtha, 1s. 6½d. Heavy naphtha, 1s. 3d. Crude, 30 per cent., naphtha, 7d. Creosote, 2d.; liquid, 2½d. Heavy oils, 35s. to 42s. 6d. Carbolic acid, 60's, 2s. Pressed naphthalene, 50s.; salts, 27s. 6d. Anthracene, "A" quality, 5½d.; "B," 4½d.

Sulphate of Ammonia.—This market is not so strong. As was expected, the sharp rise was sure to be followed by an interregnum for breathing. There are no pressing sellers, while buyers in several positions will pay £10, less 3½ per cent., which may be taken as the value at all British ports.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—There is still for the time of the year only a slow, dragging business in all descriptions of round coal; and some collieries have found it necessary to go upon short time. The better qualities are but in very restricted request for house-fire purposes; and though list rates remain unchanged, prices are easier in the open market. Common round coals are plentiful, and offering at lower prices; competition from outside districts especially being exceedingly keen. At the pit mouth, quotations for best Wigan Arley scarcely average more than 10s. to 10s. 6d. per ton: Pemberton four-feet and seconds Arley, 8s. 6d. to 9s.; common house coal, 6s. 6d. to 7s.; and steam and forge qualities, about 6s. to 6s. 6d. Engine classes of fuel move off fairly well; the limited production of slack checking surplus supplies coming upon the market. Some special descriptions are, if anything, rather scarce. Prices, however, are not more than maintained at late rates. Best slack averages 4s. 6d. to 5s. per ton at the pit; medium, 3s. 9d. to 4s. 3d.; and common, 3s. to 3s. 6d. For shipment, the demand is only moderate, with steam coal averaging about 8s. per ton delivered at the ports.

Northern Coal Trade.—Though there has been a good demand for coal, yet it is now evident that the consumption both of household and of gas coal is beginning to fall off; and thus the price is affected. Best Northumbrian steam coals are now from 8s. to 8s. 3d. per ton f.o.b.; second qualities vary from 7s. 9d. to 8s.; and steam smalls are about 3s. The demand for export is good for the time of year; but collieries find some difficulty in obtaining full work. In gas coals, two annual contracts have been renewed—those for Stockholm (about 75,000 tons) and for Gothenburg (some 18,000 tons). The price accepted for the first is about 10s. 11d. per ton; and making the same allowance for freight, &c., as last year, it shows an advance of about 8½d. per ton. The price for Gothenburg is rather higher; and it is said that there is a somewhat similar advance to that of the Stockholm contract just referred to. On the whole, the gas coal trade is fairly well employed; and looking at the enhanced cost of production, it may be said that some increase in the price will now be certain under all the contracts that have yet to be renewed. There is no alteration in manufacturing coals as far as the price is concerned; but the demand is a little fuller. Gas coke is unaltered in price; and the output is well taken up generally.

Scotch Coal Trade.—Trade is quieter, which is attributed to the stormy weather interfering with shipping. Prices have consequently been slightly easier all round. The home demand continues to be good. The prices are: Main, 6s. 6d. per ton f.o.b. Glasgow; ell, 7s. to 7s. 3d.; and splint, 7s. 3d. to 7s. 6d. The shipments for the week amounted to 108,414 tons—a decrease of 9035 tons upon the preceding week, and of 18,928 tons when compared with the corresponding week of last year. For the year to date, the total shipments have been 755,355 tons—showing an increase of something like 700 tons only over the same period of last year.

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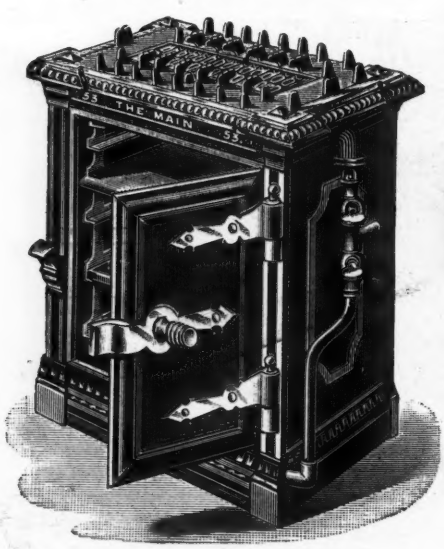

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The Winding up of the Ashford Gas Company.—A second distribution to the shareholders of the Ashford Gas Company is about to be made. Holders of £10 shares have already received £10 per share, and £5 per share has been paid to the holders of £5 shares. The second distribution, which will probably be the final one, is to be at the rate of £6 on the £10 shares, and £3 on the £5 shares; making a total paid on the £10 shares of £16, and on the £5 shares of £8. Recent purchasers of £10 shares at £20 and upwards will thus be considerable losers.

The British Gaslight Company and the Supply of Gas to the Hull Corporation.—The Chairman of the Gas Committee of the Hull Corporation (Alderman Massey) and the Town Clerk have had an interview with the Chairman and Secretary of the British Gaslight Company regarding the supply of gas in bulk to the district at present served from the Kingston-upon-Hull Gas-Works; and the terms have been practically accepted by both parties. The arrangement is that the Company shall supply gas in perpetuity; the Corporation having the power to terminate the contract on giving five years' notice. The Gas Committee have instructed the Town Clerk to prepare a draft agreement embodying the arranged terms, and to submit it for the approval of the Company.

Reductions in Price.—The Directors of the Waltham Abbey and Cheshunt Gas Company intend to reduce the price of gas 2d. per 1000 cubic feet from the 31st prox. The Directors of the Sheffield United Gas Company have decided to make a reduction of 1d. per 1000 cubic feet in the price of gas at the end of the present quarter. On the quantity of gas consumed in Sheffield in 1897, 1d. per 1000 cubic feet amounts to £9034. The Eckington and Mosboro' Gas Company have reduced the price of gas from 3s. 9d. to 3s. 4d. per 1000 cubic feet for the whole of the present year. The Stoke Town Council last Thursday agreed to the following recommendations of the Gas Committee: That after March 31 no charge be made to the Corporation for lighting, cleaning, and repairing the public lamps; that the price of gas within the borough be reduced from 3s. to 2s. 9d., and outside from 3s. 6d. to 3s. 3d. per 1000 cubic feet; that a discount of 2½ per cent. be allowed on all gas accounts paid at the gas-works office within a month from the delivery of the bill, and that the price of gas through prepayment meters be reduced from 3s. 4d. to 3s. The Easingwold Gas Company have reduced the price of gas 5d. per 1000 cubic feet. A reduction of 2d. per 1000 cubic feet has been made by the Sutton-in-Ashfield District Council.

The Lowestoft Corporation and their Gas and Water Bill.—The promotion by the Lowestoft Corporation of a Bill last year having for its object the acquisition of the Gas and Water Company's property cost them £1711; and their opposition to the Bill promoted by the Company ran them into an expenditure of £64. The Corporation Bill, it will be remembered, was thrown out. At the meeting of the Council yesterday week, the Town Clerk submitted the taxing master's certificate in relation to these amounts; and, in doing so, he made a few consolatory remarks concerning the Corporation defeat. He said it had appeared to him from the very first that the effect of the parliamentary proceedings for acquiring the gas and water properties had been entirely misconceived. The Corporation had accepted censure rather too readily; he considered that they ought rather to have congratulated themselves upon the result of the proceedings. It was obvious to anyone who looked at the result that the Corporation had substantially succeeded in carrying out their main object. They must clearly bear in mind what this object was—viz., to purify the source of the water supply of the borough. It was said by people speaking on behalf of the Company that they had always intended to purify the sources of supply, and to carry out the works now in course of construction. But not the slightest hint of this intention was given until after steps were taken by the Corporation to get the works into their own hands; and this being the case, they were justified in saying that the Company would not have moved in the matter unless the Corporation had promoted their Bill. After a few remarks by some of the members, the matter dropped.

A Coal Stack on Fire at Stroud.—The Stroud Volunteer Fire Brigade received a call from the gas-works about midday last Thursday. On arriving, they found that a stack of several hundred tons of coal, running to a depth of 14 feet in the recently-erected store, had ignited from spontaneous combustion. Dense volumes of smoke issued from the stack, though no flames were visible. The canal runs close by, so no difficulty was experienced in directing a stream of water to the spot. A considerable quantity of coal was lost; but no other damage was done.

Southampton Gas Company's Bill.—A special meeting of the shareholders of the Southampton Gas Company was held last Wednesday for the purpose of considering the Bill which the Directors have introduced into Parliament. The Chairman (Mr. R. C. Hankinson), in moving that the Bill be approved, said its objects were four. The first was to enable the Company to obtain additional capital for carrying on and extending their business. They had spent all the capital they were authorized to borrow; and he believed it had been legitimately and judiciously expended. Since 1881 they had doubled the business; and to do this, it had been necessary to keep pace with the times. The second object of the Bill was to equalize the share capital, by converting it into one 5 per cent. stock. The third object was to secure powers to acquire lands or houses, compulsorily or otherwise, as they might require for carrying on their business; and the fourth was to obtain power to apply for a Provisional Order, if necessary, for supplying electric light in their area. In consequence, however, of the opposition raised to this clause, the Directors had thought it better to withdraw it altogether. They were very sorry, of course, that such a spirit of opposition to the Bill had been stirred up throughout the district, and he for one could not understand it, as the Bill had been carefully prepared, not only in the interests of the shareholders, but in those of the consumers. The motion having been seconded, Mr. J. Birch Paddon, the Consulting Engineer, supported it. He remarked that in 1895 the capital stood at about £161,000. In the next year they obtained power to raise £150,000 more; and this had been somewhat increased by premiums upon sales of stock. By the accounts published last June, the Company appeared to have spent £322,000 in round figures. Compared with 1875, their works were now practically of three times the size and efficiency; and their assets for every £100 expended were far larger than in 1875. Gas was now manufactured so much more cheaply than formerly that they had voluntarily made a series of reductions in price from 4s. 9d. to 2s. 6d. per 1000 cubic feet. This was in a period of 22 years; and in this time they had supplied 5697 million cubic feet of gas. Taking the average of the reductions to be, say, 1s. 3d. per 1000 cubic feet, it would be found that upon the quantity of gas sold to the consumers, the reductions represented £356,000. The motion was unanimously passed.

An eight-light cluster of Bandsept burners was exhibited outside the St. James's Theatre on the occasion of the first production of "As You Like It" last Thursday, and was very successful.

The Newcastle-on-Tyne and Gateshead Gas Company have decided to introduce stoking machinery into their Redheugh works, and have accepted the tender of West's Gas Improvement Company, Limited, for a complete installation of their latest compressed air machinery with coal-breaking, elevating, and conveying machinery.

The Secretary of the New Conveyor Company, Limited, Smethwick, reports that the contracts and orders for the labour-saving specialities manufactured by the Company for gas-works and electric light stations exceeded in number, during the first six weeks of 1898, the record of any previous six months from the time the Company was formed ten years ago. The new contracts include complete installations at Newcastle-upon-Tyne, Wolverhampton, London, Liverpool, Goole, Dudley, and Stockton-on-Tees, as well as several similar plants for abroad. The Directors have decided to build and equip additional machine and fitting shops, while a new millwrights' workshop for the manufacture of transmission of power accessories has just been completed.

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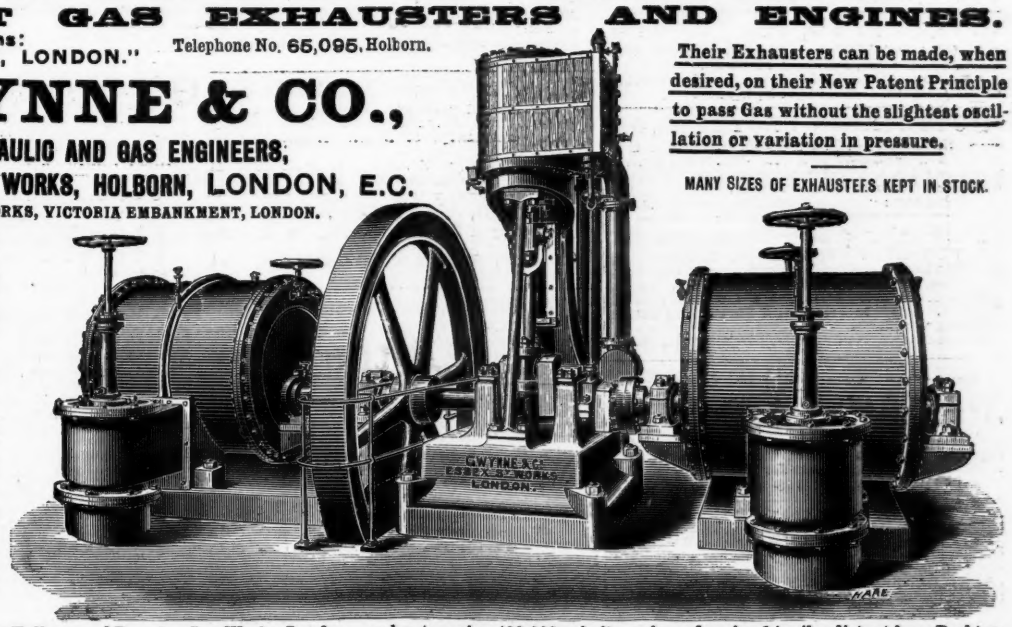

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HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

GAS TAR wanted.
BROTHERTON AND CO., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

TUBES for Gas, Steam, and Water (all Sizes) Welded or Riveted. TANKS, HYDRAULIC MAINS, RETORT-LIDS, &c.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See p. 322, last week's issue.)
Telegrams: "HUTCHINSON BROS., BARNSLEY."

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. **Compare Prices and Particulars before ordering elsewhere.**
J. F. BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c., CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special attention to Repairs.
Before placing Orders, please write for Estimate.

CANNEL, COAL, ETC.

JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, NEWTON GRANGE, NEWBATTLE, DALKEITH, } SCOTLAND.

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."
[For Illustrated Advertisement, see Feb. 1, p. 252.]

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS. Correspondence invited.

SADLER & CO., Ld., Middlesbrough; ULVERSTON (BARROW); PORTSMOUTH; CARLTON (N.E.R.); and STOCKTON. Tar and Petroleum Distillers. Benzol and Petroleum Spirit, 700 and other Gravities specially prepared for Carburetting. SOLAR OIL for Gas Making, Kerosene, &c.
Correspondence invited.
Telegraphic Address: "SADLER, MIDDLESBROUGH."

IMPORTANT.

OLD Retorts made equal to new by repairing them with CROWTHER'S PATENT STICKFAST FIRE CEMENT. Unequalled for Repairing Inclines. Can be used in Hot or Cold Retorts; and "A1." for Mouthpiece Joints. Satisfaction Guaranteed.
CROWTHER, Practical Retort Setter, Manor Street, HUDDERSFIELD.

SITUATION wanted, by a steady, reliable young Man, as STOKER or otherwise. Has had charge of small Works.
Address A. IRELAND, Lubenham, MARKET HARBOROUGH.

ADVERTISER invites Correspondence with Manufacturers of CHEMICAL MANURES in view of Export Business.
Address No. 3003, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

AGENCY wanted, to represent good House doing with Gas-Works, by old-established Firm having Central Offices in London.
Address Box 9413, care of C. Vernon, Advertising Agent, 118, Newgate Street, LONDON, E.C.

SITUATION wanted, by an experienced WORKING MANAGER or FOREMAN, in a small Country Gas-Works. Understands every practical point; also Service laying and Meter taking and Fixing. Good References.
Address No. 3006, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SITUATION required as Chief Clerk and Cashier, 21 years with a large Provincial Gas Company. Thoroughly competent to take management of Office and charge of Books. Highest possible References.
Apply, by letter, to No. 3001, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Traveller, at present calling on Gas Companies, to take additional Commission.
Address No. 3007, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, at once, two steady reliable STOKERS, used to Scoop Charging. Good character indispensable.
Apply, by letter, stating Age and Height, to No. 3005, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Cannock, Hednesford, and District Gas Company, a STOKER used to Regenerator Settings and Engine and Exhauster. Constant Employment for a suitable, steady Man.
Apply, by letter, with References, to the MANAGER, Gas-Works, Cannock, STAFFS.

WANTED, by the Portsea Island Gas-light Company, an ASSISTANT TO THE ENGINEER at the Gas-Works. Age not to exceed 40. He must have experience in the Manufacture of Gas and Manipulation of Regenerating Furnaces and general routine of Gas Production.
Apply, by letter, stating Age, Experience, Salary required, with *copies* of Testimonials, to the SECRETARY, Gas Company, PORTSMOUTH, on or before the 3rd of March next.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality. SPECIAL FIRE CEMENT, OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

SULPHURIC ACID for Sale.
BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS CARBON Wanted, not less than 4-Ton Loads.
Apply to the BRIMINGTON CARBON COMPANY, Sowerby Bridge, YORKS.

TO GAS AND WATER OFFICIALS.

SPECIALLY favourable terms for Cycles. First-Class Workmanship and Material guaranteed. Art Catalogue post free.
MELROSE CYCLE COMPANY, COVENTRY.

SPENT OXIDE wanted.
BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

WANTED, a Traveller by a Firm of Gas Engineers. One who understands Gas Engineering, and able to take Particulars for Extensions, will have preference.
Apply, stating Age, Experience, and Salary required, to No. 2998, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WATER-WORKS MANAGER.

THE Directors of the Faversham Water Company, Limited, require a competent Man as MANAGER, who will be required to give such time for the due and efficient performance of the duties as may be considered by the Directors necessary.
The duties will commence from and after the 30th of April next, and will comprise the general management of the Works and Plant, including the Mains and Services, the direction and superintendence of Extensions, and making periodical inspections of the Consumers' Fittings.
Salary £80 per annum.
Fuller Particulars of Duties may be obtained at the Secretary's Office, 50, Preston Street, Faversham.
Applications, in the Candidates' own Handwriting, stating Age, previous Employment and Qualifications and accompanied by Testimonials, to be sent to the Secretary, at his Office, on or before March 16, 1898.
By order,
FRANCIS F. GIRAUD,
Secretary.
Feb. 17, 1898.

LARGE PURIFIERS WANTED.

WANTED, a second-hand set of Four PURIFIERS in good condition, with Connections complete. Superficial area of each box 500 to 580 square feet, with 18-inch Connections.
Price and full Particulars to No. 2999, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS-PUMP for Sale, horizontal, one Steam Cylinder, 18-inch bore, and two Gas Cylinders, 17½-inch bore, all 24-inch Stroke, on massive Bed-Plate, with heavy Fly-Wheels. Very strong. First-Class Make. Not much used.
Apply, by letter, to No. 2878, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—A Modern Sulphate of AMMONIA STILL, built by Messrs. R. & J. Dempster, Manchester, 1893, with separate Liming Compartment. Capacity, with ordinary Liquor, 5000 to 6000 lbs. of Sulphate per day.
For further Particulars, apply to the BRYMBO STEEL COMPANY, LIMITED, near WREXHAM.

FOR SALE—Two Sets of Iron Mountings complete for Settings of Six 15-inch Circular Retorts. Separate Hydraulic Mains. One 8-inch FOUR-WAY VALVE, by Cockey. Twenty-one WALL BRACKETS, WALL PLATES, and BOLTS for 8-inch Cast-Iron Main.
Apply to H. WIMHURST, Gas-Works, SLEAFORD.

ALTON GAS COMPANY.

THE above Company have for Disposal a 5000 Cubic Feet per Hour ROUND STATION METER (by Braddock), with Valves and Connections. Also one 6-inch CENTRE-VALVE for four Purifiers (three on and one off). These articles can be had very cheap. They are in thorough repair.
For Particulars, address F. BARNLEY, Gas-Works, Alton, HANTS.

FOR SALE, Cheap—The undermentioned GAS PLANT:—

		Square. Ft. in.	Deep. Ft. in.	
2	PURIFIERS,	8 0	4 6	6-in. Valves & Connections.
1	,,	7 6	4 6	6 ,, ,, ,,
2	,,	5 0	4 0	4 ,, ,, ,,
1	,,	5 0	2 9	4 ,, ,, ,,

C.-I. SCRUBBER, 36ft. 6in. high, 6ft. dia., 14-in. ,,
CONDENSER, 4 inches diameter, Vertical Pipes.
EXHAUSTER (Gwynne's) 20,000 c.f. per hour 8-in. Valves
Apply to SAML. WHILE AND SONS, 60, QUEEN VICTORIA STREET, E.C.

PURIFIERS, ETC., FOR SALE.

FOUR Purifiers, each 17 ft. by 12 ft. by 8 ft. 6 in. deep (all inside measure), with six Four-Way Valves and 14-inch Connections and Lifting Gear; also two 20,000 cubic feet per hour EXHAUSTERS. The foregoing are all in good order, and immediate delivery can be given.

Apply to

A. MACPHERSON,
Manager.

Gas-Works, Kirkcaldy,
Jan. 20, 1898.

CORPORATION OF CLITHEROE.

TENDERS FOR TAR AND LIQUOR.

THE Gas Committee invite Tenders for their surplus TAR and LIQUOR for Twelve Months from the 25th of March next.

Delivery on Gas-Works Siding into Purchaser's Tanks.

Sealed Tenders, endorsed "Tender for Tar, &c.," to be sent to the Chairman of the Gas Committee not later than Tuesday, the 1st day of March, 1898.

ROBT. BARRETT,
Manager.

Clitheroe, Feb. 18, 1898.

EXETER GASLIGHT AND COKE COMPANY.

TENDERS FOR GASHOLDER AND TANK.

THE Directors of the Exeter Gaslight and Coke Company are prepared to receive TENDERS for a THREE-LIFT GASHOLDER and STEEL TANK, to contain nearly 800,000 cubic feet.

Plans and Specifications can be obtained from the undersigned, to whom Tenders should be sent on or before Tuesday, the 8th of March next.

The Directors do not bind themselves to accept the lowest or any Tender.

W. A. PADFIELD,
Engineer.

ASHFORD URBAN DISTRICT COUNCIL, KENT.

(GAS DEPARTMENT.)

THE Council are prepared to receive TENDERS for a PHOTOMETER and other TESTING APPARATUS, particulars of which may be obtained of Mr. J. Morton, the Manager, Gas-Works, Ashford, Kent.

Sealed Tenders to be sent to my Office, 11, Bank Street, not later than Five p.m. on Friday, the 25th inst., endorsed "Photometer."

The Council do not bind themselves to accept the lowest or any Tender.

JOHN CREERY,
Clerk.

Ashford, Kent,
Feb. 16, 1898.

BOROUGH OF BRIGHOUSE.

THE Town Council are prepared to receive TENDERS for the supply of the following Stores—viz, FIRE-CLAY GOODS, IRONMONGERY, OIL, PAINTS, &c., WROUGHT-IRON TUBES and FITTINGS, and BRUSHES, required by the Gas Committee during the Year ending March 31, 1899.

Specifications and Form of Tender can be obtained on application at the Gas Engineer's Office, Mill Lane Works, Brighouse.

Sealed Tenders are to be sent in on or before Monday, the 28th day of February, 1898, addressed to the Town Clerk, Public Offices, Brighouse.

The lowest or any tender not necessarily accepted.

By order,
JAMES PARKINSON,
Town Clerk.

Public Offices, Brighouse,
Feb. 11, 1898.

GLASGOW CORPORATION.

(GAS DEPARTMENT.)

TENDERS FOR CONDENSERS.

THE Corporation of Glasgow invite TENDERS for a Set of CONDENSERS to be erected at their Dawsholm Gas-Works.

Plans may be seen, and Specification and Form of Tender obtained, at the Engineer's Office, 45, John Street, Glasgow.

Sealed Offers, marked "Tender for Condensers," to be addressed to the Subscriber, and lodged with him on or before Tuesday, the 8th of March next.

The Corporation do not bind themselves to accept the lowest or any Tender.

J. D. MARWICK,
Town Clerk.

City Chambers, Glasgow,
Feb. 16, 1898.

CORPORATION OF LEICESTER.

TAR STILLS AND CONDENSING WORMS.

THE Gas and Electric Lighting Committee of the above Corporation are prepared to receive TENDERS for the supply and erection, on Foundations provided at their Chemical Works, Aylestone Road, of six TAR STILLS, 12 ft. 6 in. by 10 ft., with CONDENSING WORMS.

Specification and Tracing can be obtained from the Engineer.

Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Stills, &c.," to be delivered at these Offices not later than Eleven o'clock a.m., on Saturday, March 12, 1898.

The Committee do not bind themselves to accept the lowest or any Tender.

ALFRED COLSON, M.Inst.C.E.

Offices: Millstone Lane,
Leicester, Feb. 19, 1898.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at the Company's Offices, Willoughby Lane, Tottenham, on Saturday, the 26th day of February inst., at Half-past Three o'clock in the afternoon precisely, to receive the Report of the Directors, the Statement of the Accounts for the Half Year ended the 31st day of December, 1897, to declare Dividends, and transact such other Business as the Act of Parliament directs.

The TRANSFER BOOKS WILL BE CLOSED from the 11th till the 28th inst., both days inclusive.

By order of the Board of Directors,
JAMES RANDALL,
Secretary.

Offices of the Company:
Willoughby Lane, Tottenham,
Feb. 11, 1898.

BRIGHTON AND HOVE GENERAL GAS COMPANY.

TO THE PROPRIETORS.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Company's Offices, No. 5, Great Winchester Street, London, on Friday, the 11th of March, 1898, at Two o'clock in the afternoon precisely, to receive the Report of the Directors and the Accounts of the Company for the Half Year ended the 31st of December, 1897, to declare Dividends, to elect two Directors, to appoint a Special Auditor, and for other purposes.

The TRANSFER BOOKS of the Company WILL BE CLOSED from the 26th of February to the 11th of March, both days inclusive.

By order,
ERNEST L. BURTON,
Secretary.

5, Great Winchester Street,
London, E.C., Feb. 19, 1898.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held MONTHLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by Auction of Gas and Water Stocks and Shares under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. Alfred Richards's Offices, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

PLYMOUTH AND STONEHOUSE GASLIGHT AND COKE COMPANY.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Monday, March 7, at Two o'clock, in Lots,

£10,000 OF ORDINARY STOCK
OF THE
PLYMOUTH AND STONEHOUSE GASLIGHT AND COKE COMPANY,

Ranking for a Standard Dividend of 5 per cent., subject to the Sliding-Scale; the last Dividend on similar Stock in the Company having been at the rate of 6½ per cent.

Particulars may be obtained at the COMPANY'S OFFICES, 1, Athenæum Terrace, PLYMOUTH; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors.

HAYWARD'S HEATH DISTRICT GAS COMPANY.

NEW ISSUE OF 400 £10 SHARES,

Ranking for a Standard Dividend of 7 per cent.; the last Dividend on similar Shares having been at the rate of £8 1s. per cent.

MR. ALFRED RICHARDS will Sell the above BY AUCTION, at the Mart, E.C., on Monday, March 7, at Two o'clock, in Lots.

Particulars may be obtained of the SECRETARY, at the Company's Offices, 85, GRESHAM STREET, E.C.; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors.

EPSOM AND EWELL GAS COMPANY.

£1500 OF FIVE PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the above BY AUCTION, at the Mart, E.C., on Monday, March 7, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

LEA BRIDGE DISTRICT GAS COMPANY.

650 £10 SHARES

Ranking for a Standard Dividend of 7 per cent.

MR. ALFRED RICHARDS will Sell the above BY AUCTION, at the Mart, E.C., on Wednesday, March 16, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

ALEXANDER CAMERON,

GAS AND CANNEL COAL MERCHANT,

48, WEST REGENT STREET,

GLASGOW.

COUNTY BOROUGH OF BOLTON.

(GAS DEPARTMENT.)

THE Gas Committee of the above Corporation invite TENDERS for the supply, during the Year ending the 31st of March, 1899, of the following Articles, viz:—

LEAD TUBE,
CAST-IRON PIPES,
WROUGHT-IRON TUBING,
GAS-METERS,
SULPHURIC ACID;

Also for the Purchase during the same period of the production of

TAR,
RETORT CARBON.

Further Particulars and Form of Tender for any of the above may be obtained on application to Mr. William Walch, Office Superintendent, Gas Offices, Bolton.

Sealed Tenders, endorsed "Lead Tube," &c., to be delivered at these Offices not later than Thursday, the 10th day of March.

JOHN MILES,
Chairman.

Gas Offices, Bolton,
Feb. 21, 1898.

PATENTS, DESIGNS, AND TRADE MARKS ACTS, 1883 TO 1888.

NOTICE is Hereby Given, that the Somzée-Greyson Intensified Gas-Light Syndicate, Limited, of Winchester House, Old Broad Street, London, have applied for leave to AMEND THE SPECIFICATION OF THE LETTERS PATENT No. 8509, of 1896, granted to Paul Greyson de Schodt for "New or Improved System and Means of Illuminating and Heating, applicable with Gas and Mineral Oils."

Particulars of the proposed Amendments were set forth in the "Illustrated Official Journal (Patents)" issued on the 9th of February, 1898.

Any person or persons may give Notice of opposition to the Amendment (on Form G), at the Patent Office, 25, Southampton Buildings, London, W.C., within One Calendar Month from the date of the said "Journal."

(Signed) C. N. DALTON,
Comptroller-General.

HASELTINE, LAKE, AND CO.,
45, Southampton Buildings,
Chancery Lane, London, W.C.,
Agents for the Applicants.

J. A. & W. THARP, Auctioneers, Surveyors, and Estate Agents, 9, Norton Folgate, BISHOPSGATE STREET, E., and Leytonstone, ESSEX.

PERIODICAL SALES of FREEHOLD and LEASEHOLD PROPERTIES, STOCKS, SHARES, and DEBENTURES, held at the Mart. Rents Collected and Estates Managed in all parts of London and Suburbs.

Inclusive Terms on receiving Instructions.

STOCK AND SHARE SALE, FEB. 24, AT TWO O'CLOCK.

J. A. & W. THARP will include in their SALE, as above, SHARES and DEBENTURES in the following established Dividend-Paying Companies:—

Commercial Gas Company.
Clacton-on-Sea Gas and Water Company, Limited.
West Ham Gas Company.
Patent Victoria Stone Company, Limited.
Swan and Edgar, Limited (Preference).
Maple and Co., Limited (Preference).
Pavilion Theatre, Limited.
Lea Bridge, Leyton, and Walthamstow Tramways Co.
London General Omnibus Company, Limited.
London Road-Car Company, Limited.
National Safe Deposit Company, Limited.
East London Railway (Debenture Stock).
Belle Steamers, Limited.
Apollinaris and Johannis, Limited.

AUCTION OFFICES: 9, Norton Folgate, BISHOPSGATE STREET, E.

Telephone: Castleford No. 214. | **Postal Address: Castleford.**

Telegrams: "Silkstone Castleford."

THE SILKSTONE & HAIGH MOOR COLLIERIES, LTD.

ALLERTON BYWATER, CASTLEFORD.

Steam, Manufacturing, & Gas Coals & Cannel.

Analysis, Contracts, Trial Waggons, and Quotations for Large and Small Orders. Inquiries Solicited.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and Yield of Gas. Above the Average in Weight and Quality of Coke.

Maintains a High Standard in Residuals.

THE GRASSMOOR CO., LD.

CHESTERFIELD.

SANDELL'S

Gas Companies' Account Books.

The Gas Companies' Expenditure Journal.

With Printed Headings and Analyzing Guide, for keeping the Expenditure of Gas Companies upon the easiest and most correct method, and in accordance with the provisions of the Gas-Works Clauses Act of 1871. Size, 16⅜ in. by 17½ in.

Price: Half-bound, cloth sides, two quires, 36s.; three quires, 45s.

This Book and its predecessor (on the same principle) have been in use since 1867.

The Gas Companies' Rental Book.

A companion Book to above with Printed Headings and Illustration, for keeping the Consumers' Accounts.

Size and Price as above.

The Analyzed Wages Book.

Compiled for use in conjunction with the above Expenditure Journal, with Printed Headings. Size, 15 in. by 10½ in.

Price: Half-bound, cloth sides, two quires, 15s.

Published by SPOTTISWOODE & Co., 54, Gracechurch Street. E.C., and may also be had from CHARLES SANDELL, 3, Jeffrey's Square, St. Mary Axe, E.C.

GAS PURIFICATION BY
HYDRATED OXIDE.

THIS Material is of full Strength, and Exceptional Activity. It is specially prepared to minimize Back-Pressure; and will be supplied on Hire, or Sold, on the most favourable Terms.

SPENT OXIDES containing Blue, also CRUDE FERRO-CYANIDE PRODUCTS, either PURCHASED or EXCHANGED for FRESH OXIDE.

MANCHESTER OXIDE COMPANY, LTD., CANAL ST., MILES PLATTING, MANCHESTER.

PRICE'S COKE & COAL BARROW

effects a great saving of time, labour, and expense.

For Particulars, Price, &c., apply to Mr. EDWARD PRICE, 119, Queen's Road, FINSBURY PARK, N.

Prices are Reduced.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,
MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY
FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their
GREATER DURABILITY,
Strongly recommended where EXCESSIVE HEATS have to be maintained.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

HOLMSIDE

GAS COALS.

Present Daily Produce over 5000 Tons.

Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton	11,205 Cubic Feet.
Illuminating Power	16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality)	13¾ Cwt. per Ton.
Sulphur	A little over 1 per Cent.
Ash	Under 1 per Cent.
Tar	163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor	103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England, and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR

PELTON GAS COALS.

Present Daily Produce available 3000 Tons.

Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.

Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE & SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

E. ASQUITH & CO.,
Hydraulic Engineers,
17, Mather Street, Ancoats, Manchester,
Fit up Plants for
Pressing Anthracene, Naphthalene, &c.
Competent Men sent out to erect same. Estimates given.

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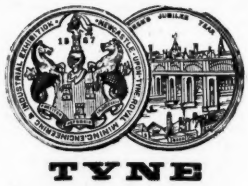

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Yield of Gas per ton	13,155 cub.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

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Coke	70 per cent.

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ANALYSIS.

Yield of Gas per ton .	10,500	Cubic Feet.
Illuminating Power .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

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OUT OF THEIR
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Analysis made by
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Yield of Gas per Ton . .	10,500 Cub. Ft.
Illuminating Power . .	16·9 Candles.
Coke (of good quality) . .	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

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FOR ENRICHING GAS IN BULK.
OVER 60 MAXIM PATENT CARBURETTORS HAVE NOW BEEN FIXED.

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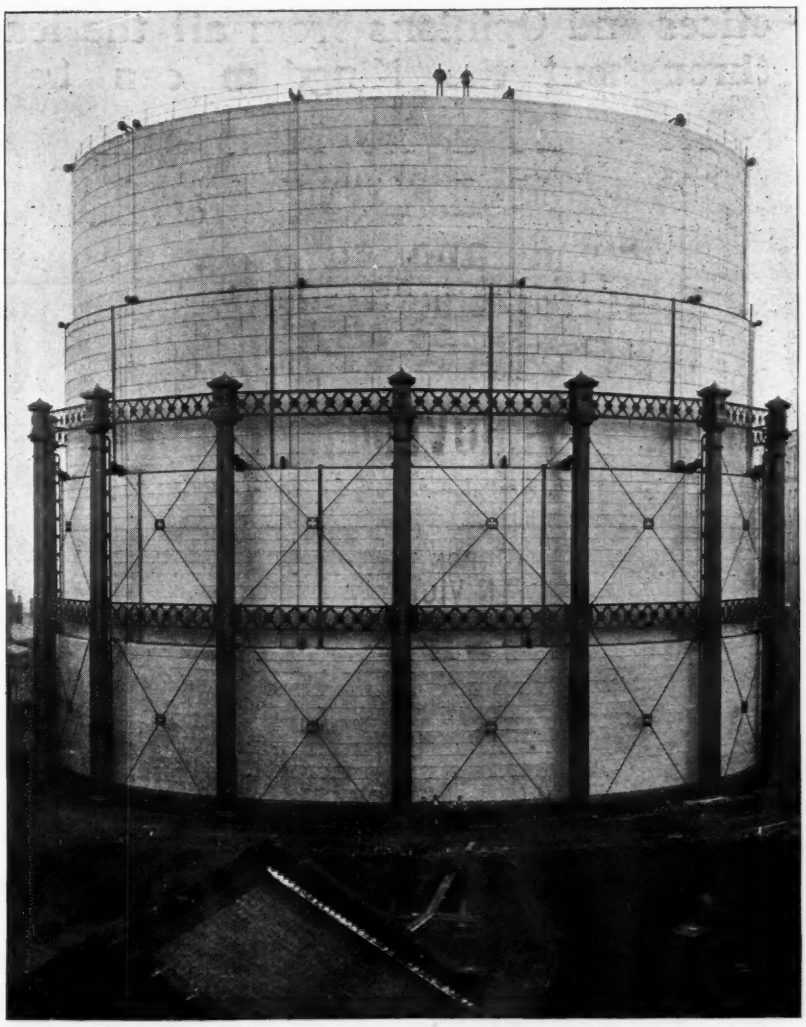

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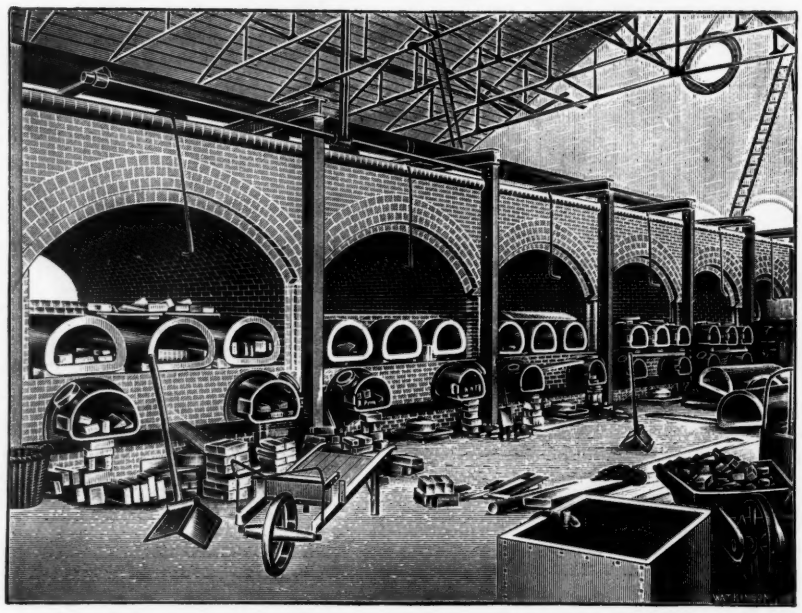

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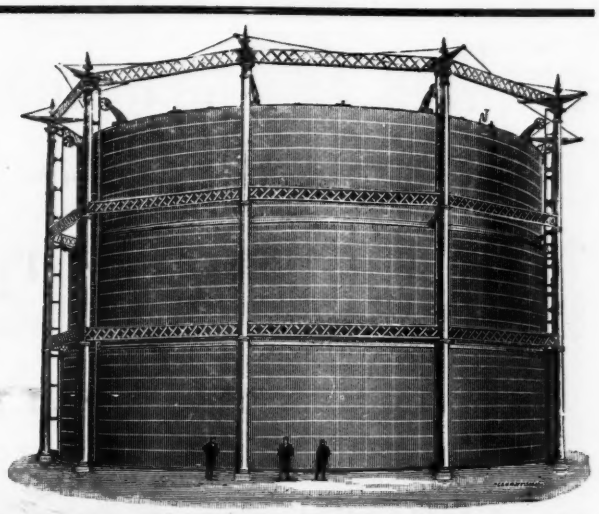

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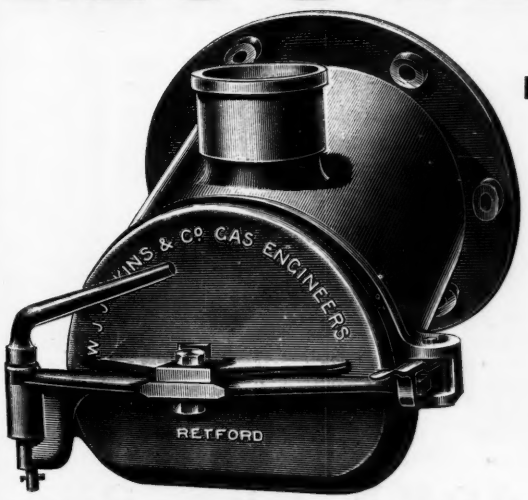

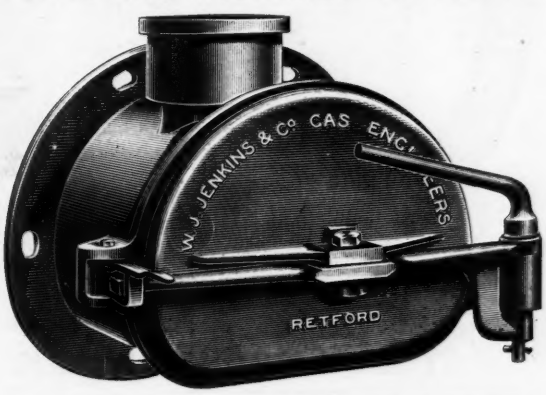

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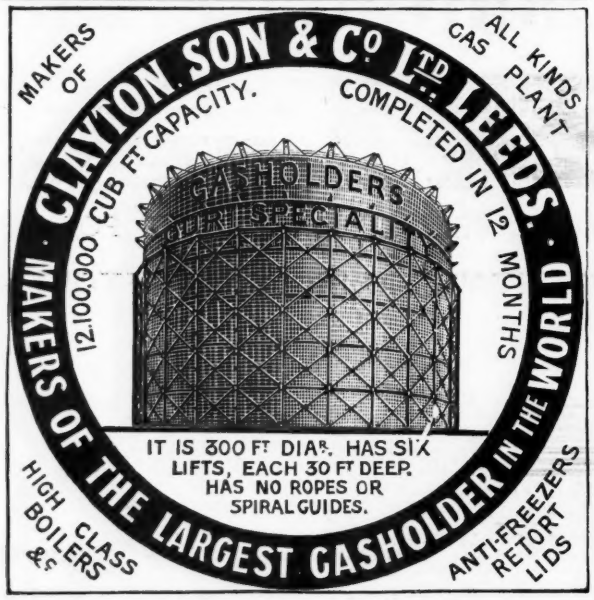
[See Illustrated Advertisement, Feb. 1, p. 213.]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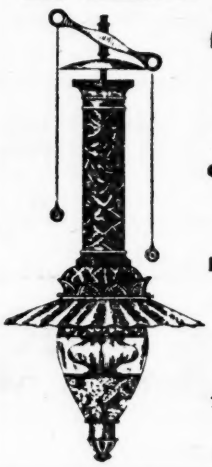

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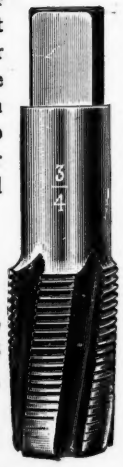

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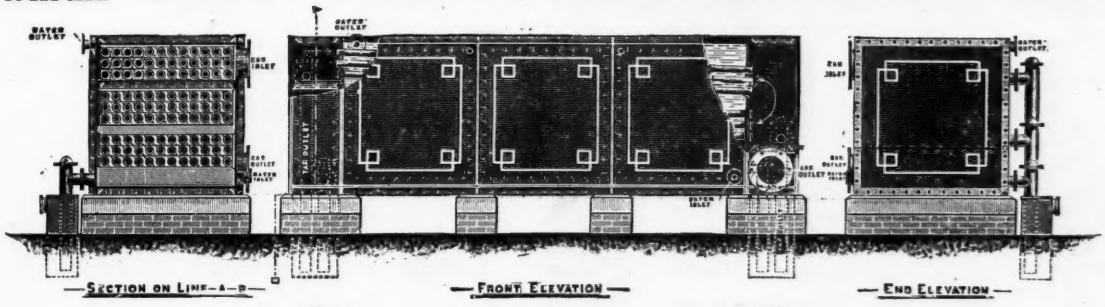

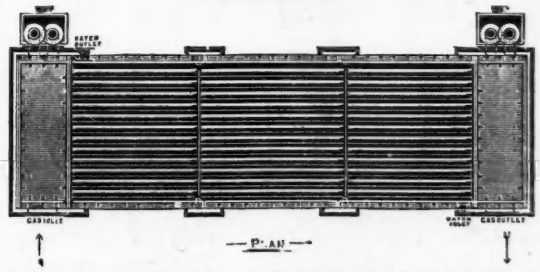

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[See also Advt. p. 390.

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